

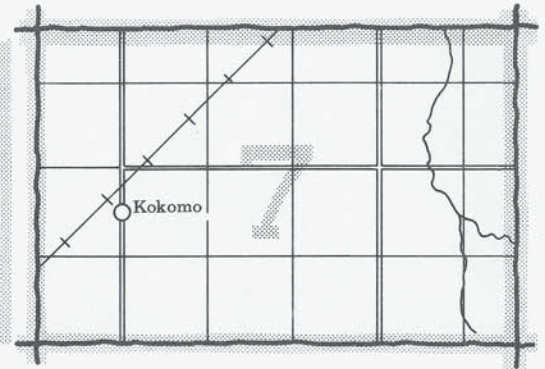
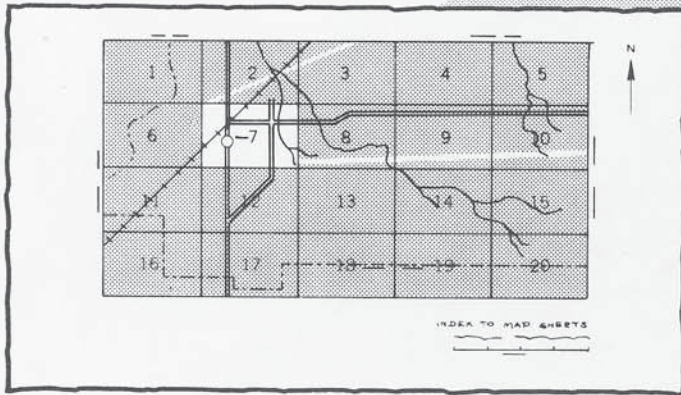
soil survey of Jackson County, Michigan



United States Department of Agriculture
Soil Conservation Service
in cooperation with
Michigan Agricultural Experiment Station

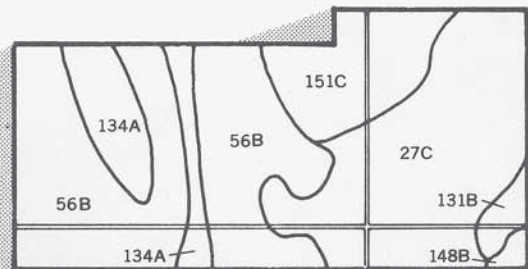
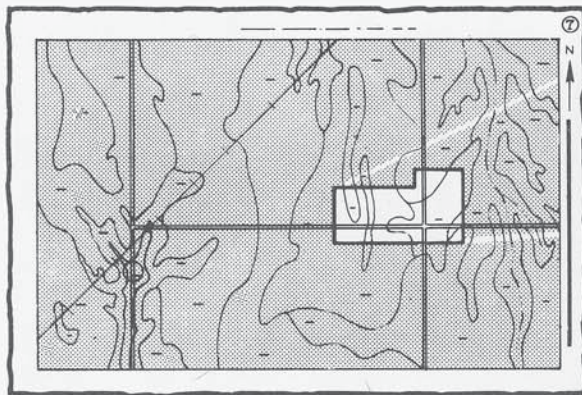
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

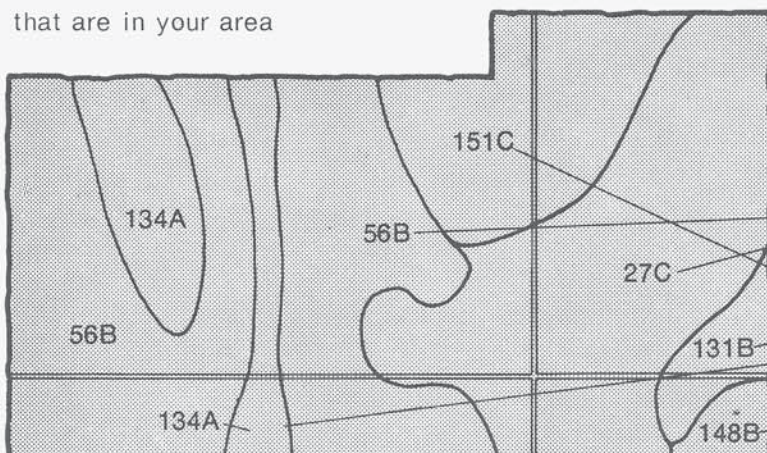


2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



4. List the map unit symbols that are in your area



Symbols

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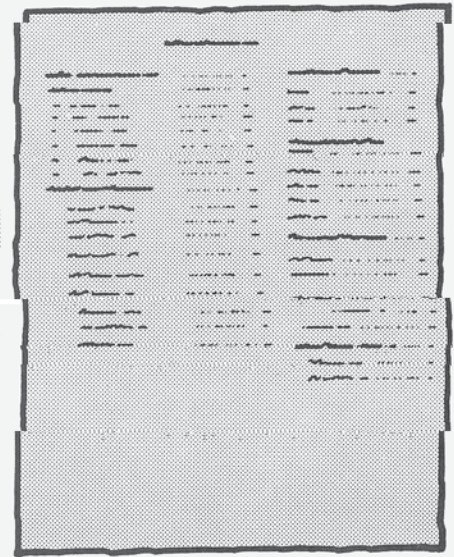
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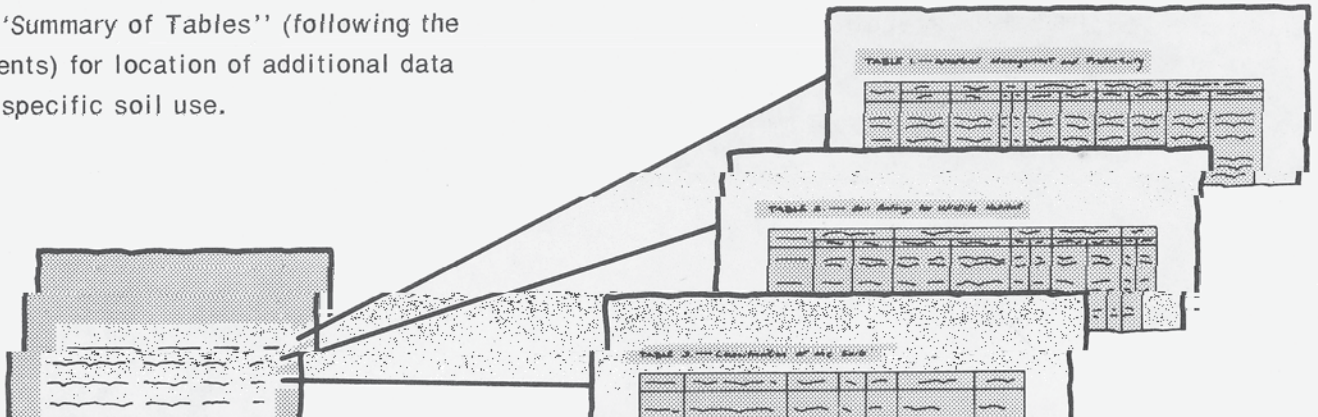
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which lists the name of each map unit and the page where that map unit is described.



See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

This survey was made cooperatively by the Soil Conservation Service and the Michigan Agricultural Experiment Station. It is part of the technical assistance furnished to the Jackson County Soil and Water Conservation District. Major fieldwork for this soil survey was performed in the period 1973-78. Soil names and descriptions were approved in September 1978. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1978.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

This soil survey supersedes the soil survey of Jackson County published in 1926 (7).

Cover: Typical areas of the Boyer-Oshtemo-Houghton association (foreground) and the Boyer-Hillsdale-Houghton association (background) on the general soil map.

"Preparation of this survey was partly financed by the Jackson County Board of Commissioners under provisions of an agreement with the Soil Conservation Service, United States Department of Agriculture."

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foreword

This soil survey contains information that can be used in land-planning programs in Jackson County, Michigan. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations inherent in the soil or hazards that adversely affect the soil, improvements needed to overcome the limitations or reduce the hazards, and the impact of selected land uses on the environment.

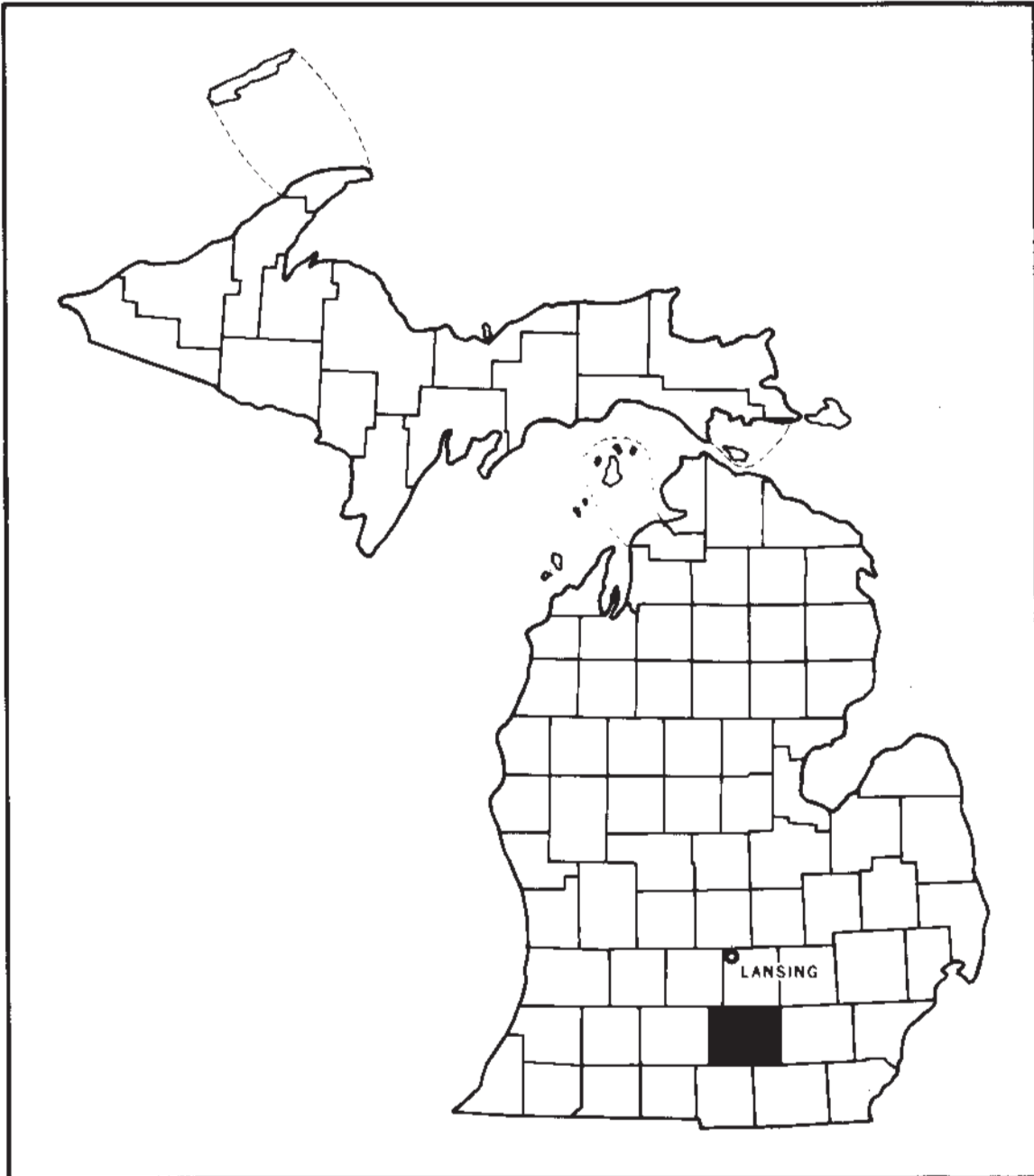
This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.



Arthur H. Cratty
State Conservationist
Soil Conservation Service



Location of Jackson County in Michigan.

soil survey of Jackson County, Michigan

By Robert L. McLeese, Soil Conservation Service

Soils surveyed by James Barnes, William Bowman, Robert Engel, Donald Gibbs, Robert McLeese, Willard Ryland, Charles Schwenner, Martin Urka, and Gregory Whitney, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service
in cooperation with Michigan Agricultural Experiment Station

JACKSON COUNTY is in the south-central part of Michigan's lower peninsula. It has an area of about 717 square miles, or 458,880 acres. The city of Jackson is the county seat and the commercial, industrial, and educational center of the county. The population of the county in 1970 was about 143,274.

About 55 percent of the land in the survey area is used for cash crops, dairying, and other farm enterprises. The chief cash crop is corn. About 21 percent of the land in the survey area is woodland. About 12 percent is urban land and built-up land. About 8 percent of the land in the survey area is idle. About 4 percent is used for parks and other recreation uses. Most of that land is woodland.

Soil scientists determined that there are about 62 different kinds of soils in Jackson County. The soils range widely in texture, natural drainage, slope, and other characteristics. Well drained soils make up about

climate

Prepared by the Michigan Department of Agriculture, Michigan Weather Service, East Lansing, Michigan.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Jackson in the period 1948 to 1977. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 24.7 degrees F, and the average daily minimum temperature is 17.4 degrees. The lowest temperature on record, which occurred at Jackson on February 10, 1912, is -21 degrees. In summer the average temperature is 69.8 degrees, and the average daily maximum temperature is 80.9 degrees. The highest recorded temperature, which occurred at Jackson on July 14, 1936, is 105 degrees.

Growing degree days are shown in table 1. They are

June than in any other month; however, only slightly fewer occur in July and in August.

Average seasonal snowfall is 37.4 inches. The greatest snow depth at any one time during the period of record was 27 inches. On an average of 63 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity at 1:00 p.m. at the Lansing Capitol City Airport is about 63 percent. Humidity is higher at night, and the average at dawn is about 83 percent. The sun shines 68 percent of the time possible in summer and 36 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 12.2 miles per hour, in January.

physiography

Jackson County is in the physiographic division of Michigan's lower peninsula known as the Thumb Upland (7). This is a broad glaciated upland extending from the Ohio-Indiana State line northeastward to Huron County in Michigan.

Most of the topographic features of the county are a result of erosion or deposition during the Wisconsin glaciation, the latest glacial period. The recession of the part of the glacier that covered Michigan began about 14,000 years ago and ended about 8,000 years ago. As the ice melted, a mantle of glacial drift was left on the beds of sandstone, limestone, and other sedimentary bedrock of Paleozoic age. This glacial drift ranges from a few feet to several hundred feet in thickness. It forms various topographic features such as moraines, till plains, outwash plains, glacial drainageways, eskers, and kames.

The Kalamazoo morainic system extending east and west through the northern half of the county is the most prominent moraine. It is generally undulating to very steep. Other moraines in the southwestern and extreme southeastern parts of the county are generally undulating and rolling.

Nearly level to rolling till plains are in the western and northeastern parts of the county and are closely associated with the moraines. A large, nearly level to rolling, pitted outwash plain is in the southeastern part of the county. Other outwash areas are scattered throughout the county. The Grand River, Portage River, North and South Branches of the Kalamazoo River, and River Raisin flow in part through valleys cut by much larger glacial rivers. Many of the lakes in the county are glacial in origin and are in the glacial drainageways. Eskers and kames are mainly in the eastern half of the

county. Marshall Sandstone is near the surface. Bayport Limestone is mined near Parma and Napoleon. Napoleon Sandstone is mined near Napoleon.

The elevation in most of Jackson County is between 950 and 1,050 feet above sea level, or about 275 to 375 feet above Lake Michigan.

lakes and streams

About 700 lakes and ponds are scattered throughout the county. These water areas differ in size, shape, and shoreline characteristics. Some are circular and less than 3 acres, and some are irregularly shaped and more than 800 acres. Some water areas, those on uplands, have clean, sandy shores; some are in marshes and exhibit all stages of filling by vegetation. The larger lakes are concentrated in the eastern half of the county. Among the larger lakes are Lake Columbia, which is about 880 acres; Center Lake, about 850 acres; Clarks Lake, about 510 acres; and Vineyard Lake, about 505 acres.

Jackson County has three major drainage systems, the Grand River, the North and South Branches of the Kalamazoo River, and the River Raisin.

The Grand River drains all but the southwestern and southeastern parts of the county. It has its source in a marsh southwest of Grand Lake and flows to the north. It leaves the county in Tompkins Township and eventually flows into Lake Michigan. The Portage River, Sandstone Creek, and Spring Brook are major tributaries of the Grand River.

The North and South Branches of the Kalamazoo River drain the southwestern part of the county. The source of the North Branch of the Kalamazoo River is in the county, south of Farewell Lake in Hanover Township. Both branches flow to the north, into Calhoun County.

The River Raisin drains the southeastern part of the county. It has its source in Norvell Township and flows to the east, into Washtenaw County and eventually into Lake Erie. Goose Creek is a main tributary.

history and development

The first known inhabitants of the survey area were the Potawatomi Indians, who had migrated from the south before the Revolutionary War. The Potawatomi raised such crops as corn, potatoes, cabbages, and turnips. They also had many apple and wild plum orchards.

The county area was surveyed and laid off just before

Michigan. The county and the first settlement, by then

conditioners, automotive accessories, baked goods,
~~accessories and related electronic equipment~~ infants' wear

[REDACTED]

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed

information then needs to be organized so that it can be used by farmers, woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit, or soil association, on the general soil map is a unique natural landscape. Typically, a soil association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in other associations but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

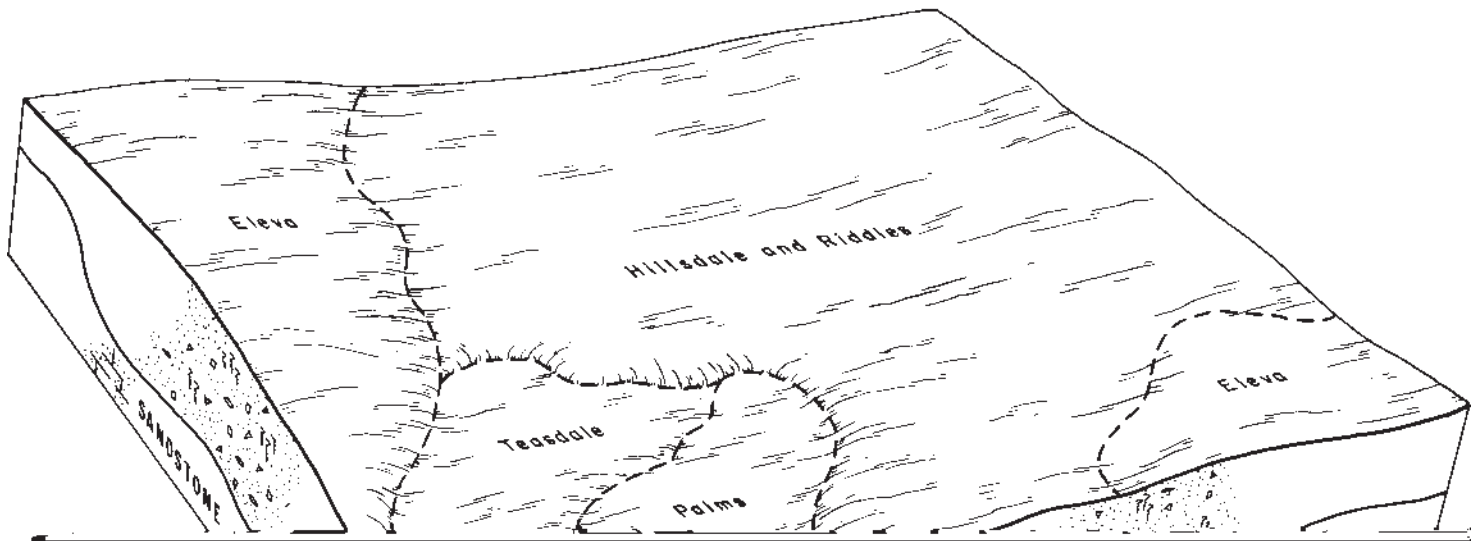
Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that

The Riddles soils have a surface layer of dark brown sandy loam and a subsurface layer of yellowish brown sandy loam. The subsoil is sandy clay loam, clay loam, and sandy loam. The substratum is sandy loam.

The soils of minor extent are the well drained Arkport, Okee, Ormas, and Spinks soils on broad upland areas and on ridges and knolls; the somewhat poorly drained Teasdale soils on broad flat areas, along drainageways, and in shallow depressions; the poorly drained Barry and Colwood soils in depressions and drainageways; the very poorly drained Gilford soils in depressions and drainageways; and the very poorly drained Histosols, Aquents, and Palms soils in bogs and other depressional areas.

The soils in this association are used mainly as cultivated cropland. In a few areas they are used as permanent pasture or as woodland. Corn is the main crop.

These soils are well suited to use as cropland and as



This association consists of built-up areas and nearly level to rolling soils on outwash plains, till plains, and moraines. The slope ranges from 0 to 30 percent but generally is less than 12 percent.

This association makes up about 3 percent of the survey area. It is about 50 percent Urban land, 10 percent Oshtemo soils, and 40 percent soils of minor extent.

Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification of the soils is not feasible.

The Oshtemo soils have a surface layer of dark brown sandy loam and a subsurface layer of yellowish brown sandy loam. The subsoil is gravelly sandy loam, gravelly sandy clay loam, and sand with bands of loamy sand. The substratum is gravelly sand.

4. Hillsdale-Riddles-Teasdale association

Deep, well drained and somewhat poorly drained, loamy soils that formed in glacial till

This association consists of nearly level to rolling soils on till plains and moraines (fig. 2). The slope is dominantly 0 to 12 percent. The Hillsdale and Riddles soils are in broad upland areas. In these areas the slope is generally steeper along the major drainageways and streams. The Teasdale soils are on the lower positions on the landscape.

This association makes up about 22 percent of the survey area. It is about 25 percent Hillsdale soils, 20 percent Riddles soils, 10 percent Teasdale soils, and 45 percent soils of minor extent.

The Hillsdale soils are deep and well drained. They

have a layer of dark brownish brown sandy loam

These soils can be used as septic tank absorption fields or for building site development; however, shrink-swell potential, slope, and depth to the water table are limitations to these uses.

5. Riddles-Teasdale-Palms association

Deep, well drained, somewhat poorly drained, and very poorly drained, loamy and mucky soils that formed in glacial till or in organic material and the underlying loamy glaciofluvial deposits

This association consists of nearly level to rolling soils on till plains and moraines, and in isolated areas of glacial till on outwash plains. The Riddles soils are in the broad upland areas, the Teasdale soils are in the lower lying broad and flat upland areas, and the Palms soils in depressional areas. The slope is dominantly 0 to 12 percent. It is generally steeper along the major drainageways and streams.

This association makes up about 14 percent of the survey area. It is about 55 percent Riddles soils, 10 percent Teasdale soils, 10 percent Palms soils, and 25 percent soils of minor extent.

The Riddles soils are deep and well drained. They have a surface layer of dark brown sandy loam and a subsurface layer of yellowish brown sandy loam. The subsoil is sandy clay loam, clay loam, and sandy loam.

of management. The Palms soils are suited to use as cropland if adequate drainage is provided. If they are cultivated, removing excess water, preventing ponding, providing adequate drainage outlets, controlling soil blowing, controlling subsidence after drainage, and overcoming equipment limitations associated with soil stability are concerns of management.

If overgrazing occurs on the Riddles soils, water erosion is a hazard. Grazing on the Teasdale soils when they are wet can cause surface compaction. The Palms soils are suited to use as pasture and hayland if adequate drainage is provided.

The soils in this association are suitable for use as woodland. Plant competition is a concern of management. Equipment limitations, seedling mortality, and windthrow are additional concerns of management if the Palms soils are used as woodland.

The upland soils can be used as septic tank absorption fields or for building site development; however, shrink-swell potential, slope, and depth to the water table are limitations to these uses. The Palms soils are not suited to these uses.

6. Marlette-Capac-Houghton association

Deep, well drained, somewhat poorly drained, and very poorly drained, loamy and mucky soils that formed in glacial till or in organic material

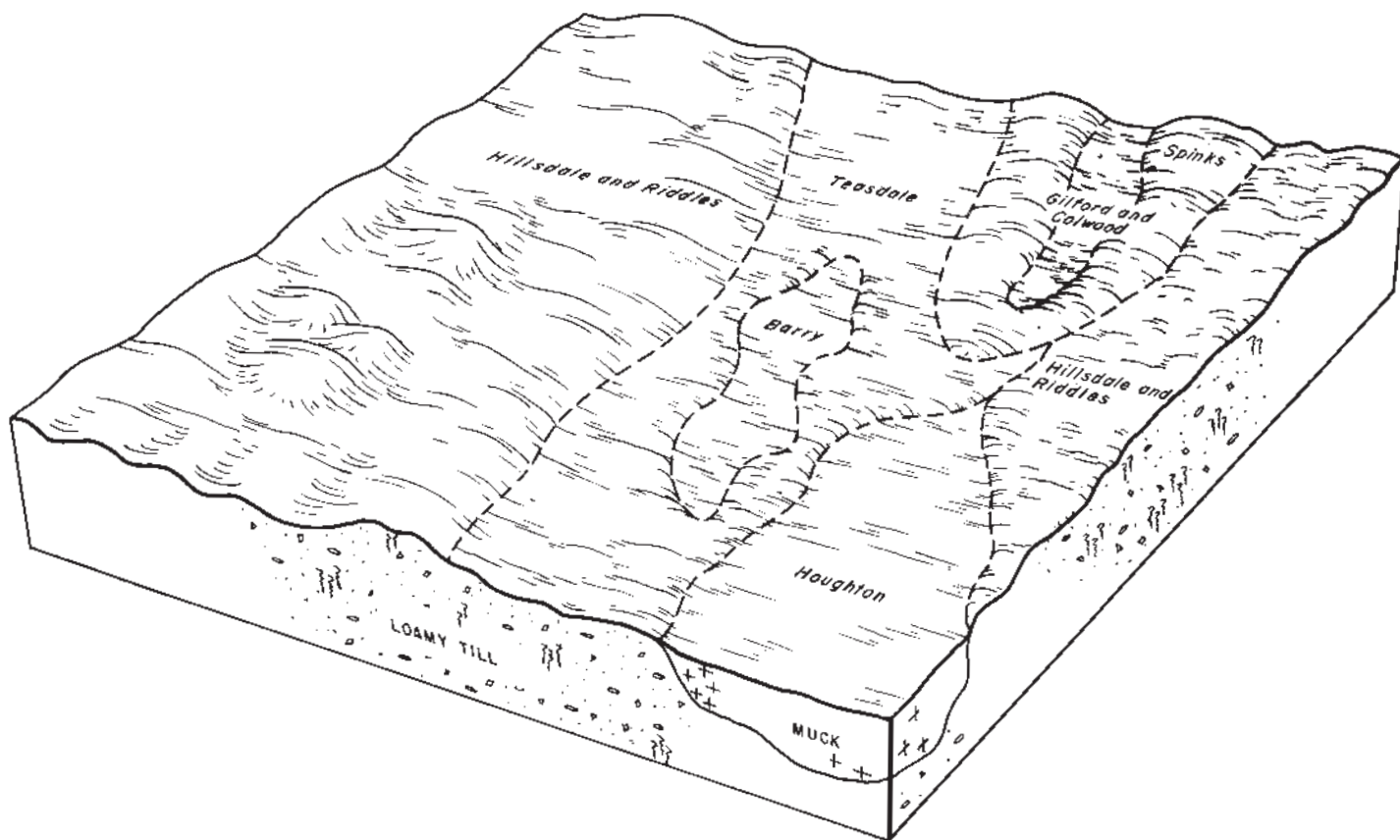


Figure 2.—Typical pattern of the soils and underlying material in the Hillsdale-Riddles-Teasdale association.

drainageways; and the very poorly drained Palms soils in bogs, depressions, and drainageways.

The soils in this association are used mainly as cultivated cropland. Corn is the main crop. In a few areas the soils are used as permanent pasture or as woodland. Most areas of the Houghton soils have a cover of natural vegetation, including trees.

The Marlette and Capac soils are suited to use as cropland and as pasture and hayland. If these soils are cultivated, controlling water erosion, maintaining good soil tilth and a high content of organic matter, and removing excess water during wet periods are concerns of management. The Houghton soils are suited to use as cropland if they are adequately drained.

If overgrazing occurs on the Marlette soils, water erosion is a hazard. Grazing on the Capac soils when they are wet can cause surface compaction. The Houghton soils are suited to use as pasture and hay if adequate drainage is provided.

The soils in this association are suitable for use as woodland. Plant competition is a concern of management. Equipment limitations, seedling mortality, and windthrow hazard are additional concerns if the

Houghton soils are used as woodland.

The Marlette and Capac soils can be used as septic tank absorption fields or for building site development; however, shrink-swell potential, low strength, permeability, slope, and depth to the water table are limitations that affect building site development and permeability, slope, and depth to the water table are limitations that affect septic tank absorption fields. The Houghton soils are not suited to these uses.

dominantly nearly level to rolling, deep soils that are well drained and very poorly drained

The soils in these associations are generally suited to use as cropland. If they are cultivated, soil blowing, water erosion, and droughtiness are hazards.

The well drained soils in these associations are suited to most building site development; however, slope is a limitation in some areas. If these soils are used for onsite waste disposal pollution of ground water is a hazard because of inadequate filtration of the effluent. Onsite waste disposal and building site development are not practical on the very poorly drained organic soils in these associations.

7. Spinks-Ormas-Houghton association

Deep, well drained and very poorly drained, sandy and mucky soils that formed in glaciofluvial deposits or in organic material

This association consists of nearly level to rolling soils on outwash plains, in glacial drainageways, and on moraines (fig. 3). The Spinks and Ormas soils are in the broad upland areas, and the Houghton soils are in depressional areas. The slope is dominantly 0 to 12 percent.

This association makes up about 23 percent of the survey area. It is about 25 percent Spinks soils, 15 percent Ormas soils, 10 percent Houghton soils, and 50 percent soils of minor extent.

The Spinks soils are deep and well drained. They have a surface layer of dark brown sand and a subsurface layer of brownish yellow and light yellowish brown sand.

The subsurface layer consists of sand and bands of fine subsurface layer of yellowish brown loamy sand. The subsoil is sandy loam, sandy clay loam, loamy sand, and gravelly sandy loam. The substratum is gravelly sand.

The Houghton soils are deep and very poorly drained. They have a surface layer of black muck. The underlying layers are muck.

The soils of minor extent are the well drained Arkport, Okee, Boyer, and Oshtemo soils in broad upland areas, on knolls and ridges, and along drainageways; the somewhat poorly drained Brady and Dixboro soils in broad, flat areas, on low knolls and ridges, on foot slopes, along drainageways, and in shallow depressions; the poorly drained Colwood soils and the very poorly drained Gilford soils in depressions and drainageways; and the very poorly drained Palms soils in bogs and other depressional areas.

The soils in this association are used mainly as cultivated cropland. Corn is the main crop. In a few

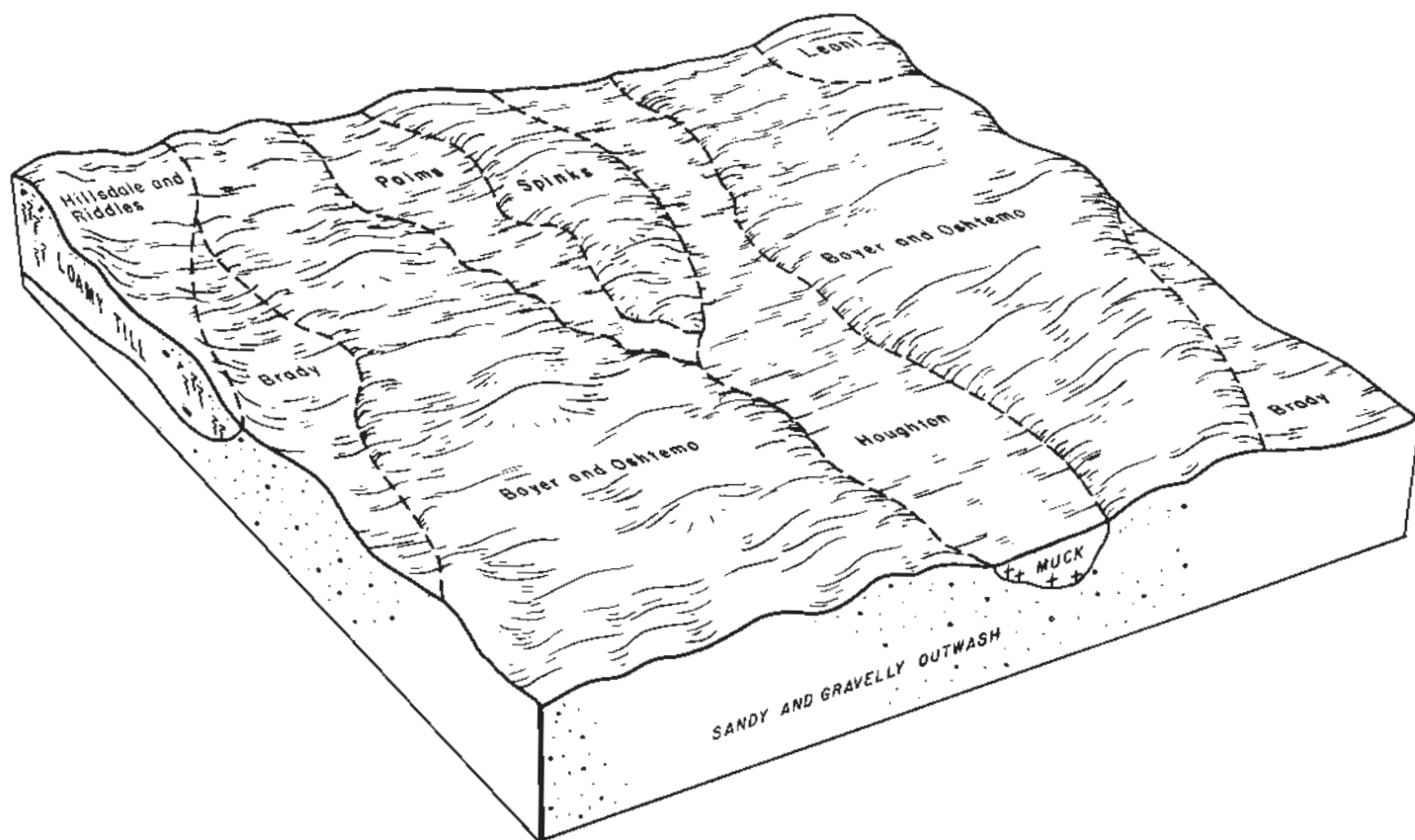


Figure 4.—Typical pattern of the soils and underlying material in the Boyer-Oshtemo-Houghton association.

The well drained soils are suited to use as cropland and as pasture and hayland. If they are cultivated, controlling water erosion, maintaining a high content of organic matter, and conserving moisture during dry periods are concerns of management. If they are used as pasture or hayland, the hazard of droughtiness is a concern.

The Houghton soils are suited to use as cropland and as pasture and hayland if they are adequately drained. If they are cultivated, removing excess water, preventing ponding, providing adequate drainage outlets, controlling soil blowing and subsidence after drainage, and overcoming equipment limitations are concerns of management.

The soils in this association are suitable for use as woodland. Plant competition and seedling mortality are concerns of management. Windthrow hazard and equipment limitations are additional concerns if the Houghton soils are used as woodland.

The well drained soils are well suited to most building site development; however, they are poorly suited to onsite waste disposal. The slope and inadequate filtration capacity of the soils are limitations to these uses. The Houghton soils are not suited to building site development or to onsite waste disposal.

8. Boyer-Oshtemo-Houghton association

Deep, well drained and very poorly drained, loamy and mucky soils that formed in glaciofluvial deposits or in organic material

This association consists of nearly level to rolling soils on outwash plains and moraines and in glacial drainageways (fig. 4). The Boyer and Oshtemo soils are in the broad upland areas, and the Houghton soils are in depressional areas. The slope ranges from 0 to 40 percent.

This association makes up about 19 percent of the survey area. It is about 30 percent Boyer soils, 15 percent Oshtemo soils, 10 percent Houghton soils, and 45 percent soils of minor extent.

The Boyer soils are deep and well drained. They have a surface layer of dark brown sandy loam. The subsoil is sandy loam and gravelly sandy loam. The substratum is very gravelly sand.

The Oshtemo soils are deep and well drained. They have a surface layer of dark brown sandy loam and a subsurface layer of yellowish brown sandy loam. The subsoil is gravelly sandy loam, sandy clay loam, and

sand that contains bands of loamy sand. The substratum is gravelly sand.

The Houghton soils are deep and very poorly drained. They have a surface layer of black muck. The underlying layers are muck.

The soils of minor extent are the well drained Hillsdale, Ormas, Riddles, Spinks, and Leoni soils in broad upland areas, on knolls and ridges, and along drainageways; the somewhat poorly drained Brady soils in broad flat areas and shallow depressions, on knolls and ridges, and along drainageways; the poorly drained Colwood soils and the very poorly drained Gilford soils in depressions and drainageways; and the very poorly drained Palms soils in bogs, depressions, and drainageways.

The soils in this association are used mainly as cultivated cropland. Corn is the main crop. In a few areas the soils are used as permanent pasture or as woodland. Most areas of the Houghton soils have a cover of natural vegetation, including trees; some areas are drained for use as cropland.

The well drained soils are suited to use as cropland and as pasture and hayland. If they are cultivated, controlling water erosion, maintaining a high content of organic matter, and conserving moisture during dry periods are concerns of management. If they are used as pasture or hayland, the hazard of droughtiness is a concern.

The Houghton soils are suited to use as cropland and as pasture and hayland if they are adequately drained. If they are cultivated, removing excess water, preventing ponding, providing adequate drainage outlets, controlling soil blowing and subsidence after drainage, and overcoming equipment limitations are concerns of management.

The soils in this association are suitable for use as woodland. Plant competition is a concern of management. Seedling mortality, windthrow hazard, and equipment limitations are additional concerns if the Houghton soils are used as woodland.

The well drained soils are well suited to most kinds of building site development; however, they are poorly suited to onsite waste disposal. Slope and poor filtering capacity are limitations to onsite waste disposal. The Houghton soils are not suited to building site development or to onsite waste disposal.

The soils are poorly suited to use as cropland. They are best suited to use as woodland or pasture.

The well drained soils are poorly suited to onsite waste disposal and to use as building sites because of

slope. The very poorly drained organic soils are not suited to these uses.

9. Boyer-Hillsdale-Houghton association

Deep, well drained and very poorly drained, loamy and mucky soils that formed in glaciofluvial deposits, glacial till, or organic material

This association consists of nearly level to very steep soils on moraines. The Boyer and Hillsdale soils are on hills and high ridges, and the Houghton soils are in depressional areas (fig. 5). The slope ranges from 0 to 40 percent.

This association makes up about 2 percent of the survey area. It is about 30 percent Boyer and similar soils, 25 percent Hillsdale and similar soils, 15 percent Houghton soils, and 30 percent soils of minor extent.

The Boyer soils are deep and well drained. They have a surface layer of dark brown sandy loam. The subsoil is sandy loam and gravelly sandy loam. The substratum is very gravelly sand.

The Hillsdale soils are deep and well drained. They have a surface layer of dark grayish brown sandy loam and a subsurface layer of dark yellowish brown sandy loam. The subsoil is sandy loam. The substratum is sandy loam till.

The Houghton soils are deep and very poorly drained. They have a surface layer of black muck. The underlying layers are muck.

The soils of minor extent are the well drained Arkport, Okee, Ormas, Oshtemo, Riddles, Spinks, and Leoni soils on hills and ridges; the poorly drained Colwood soils and the very poorly drained Gilford soils in depressions and drainageways; and the very poorly drained Palms and Napoleon soils in bogs.

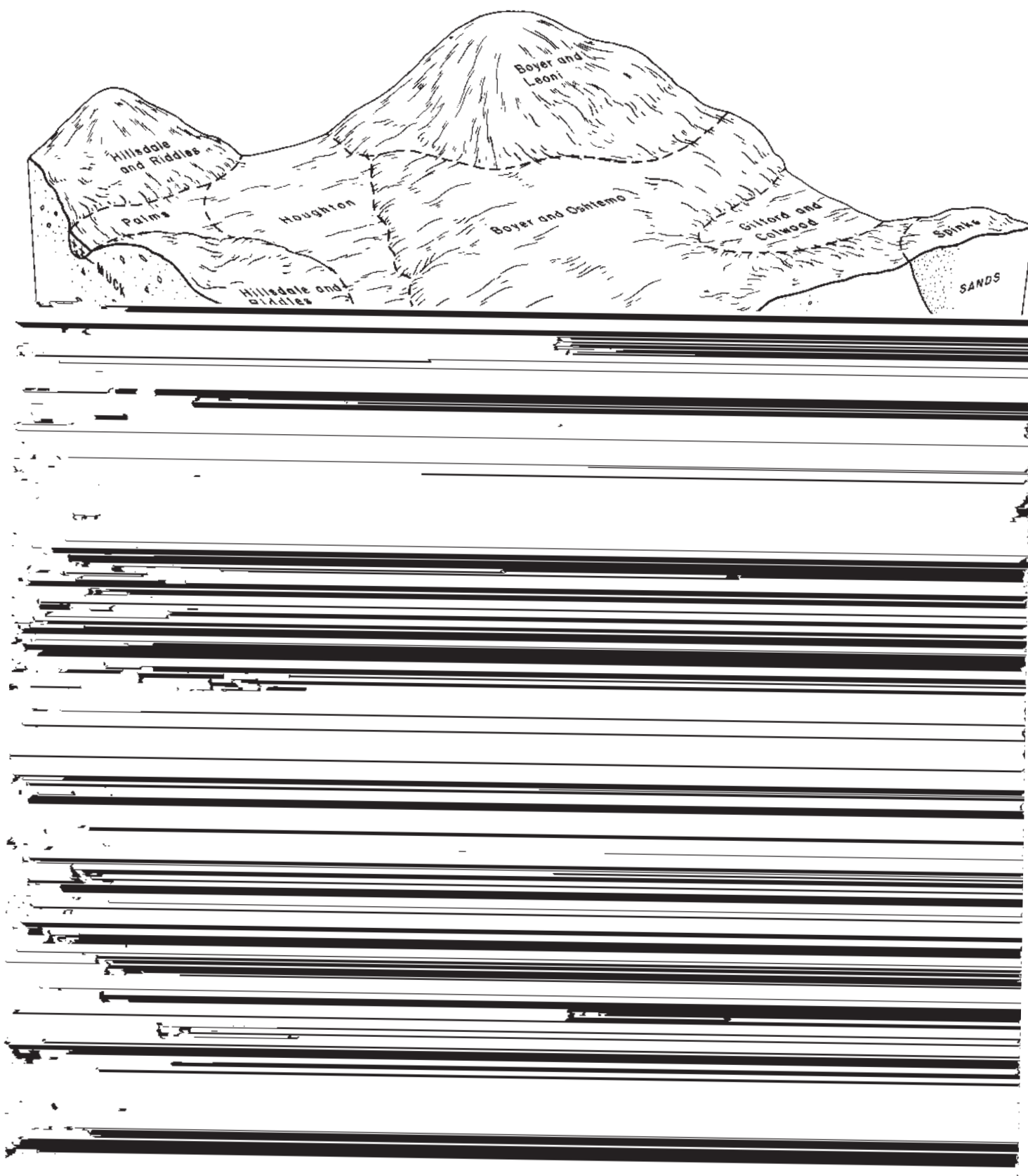
This association is used mainly for recreation and as wildlife habitat. Most of the acreage is woodland; a small acreage is permanent pasture.

Crop production is generally not practical on these soils because of the steepness of slope. However, some of the larger areas of Houghton soils, if drained, are suitable for crops, particularly specialty crops.

The soils in this association are suited to pasture plants, which can control erosion. Droughtiness is a hazard to the use of the well drained soils as pasture. Artificial drainage is needed if the Houghton soils are used as pasture.

The soils in this association are well suited to woodland use. Plant competition, seedling mortality, equipment limitations, and the hazards of windthrow and water erosion, however, are concerns of management.

These soils are poorly suited to building site development and to onsite waste disposal. Slope is a limitation on the Boyer and Hillsdale soils. Poor filtering capacity is an additional limitation on the Boyer soils. The Houghton soils are not suited to building site development or to onsite waste disposal.



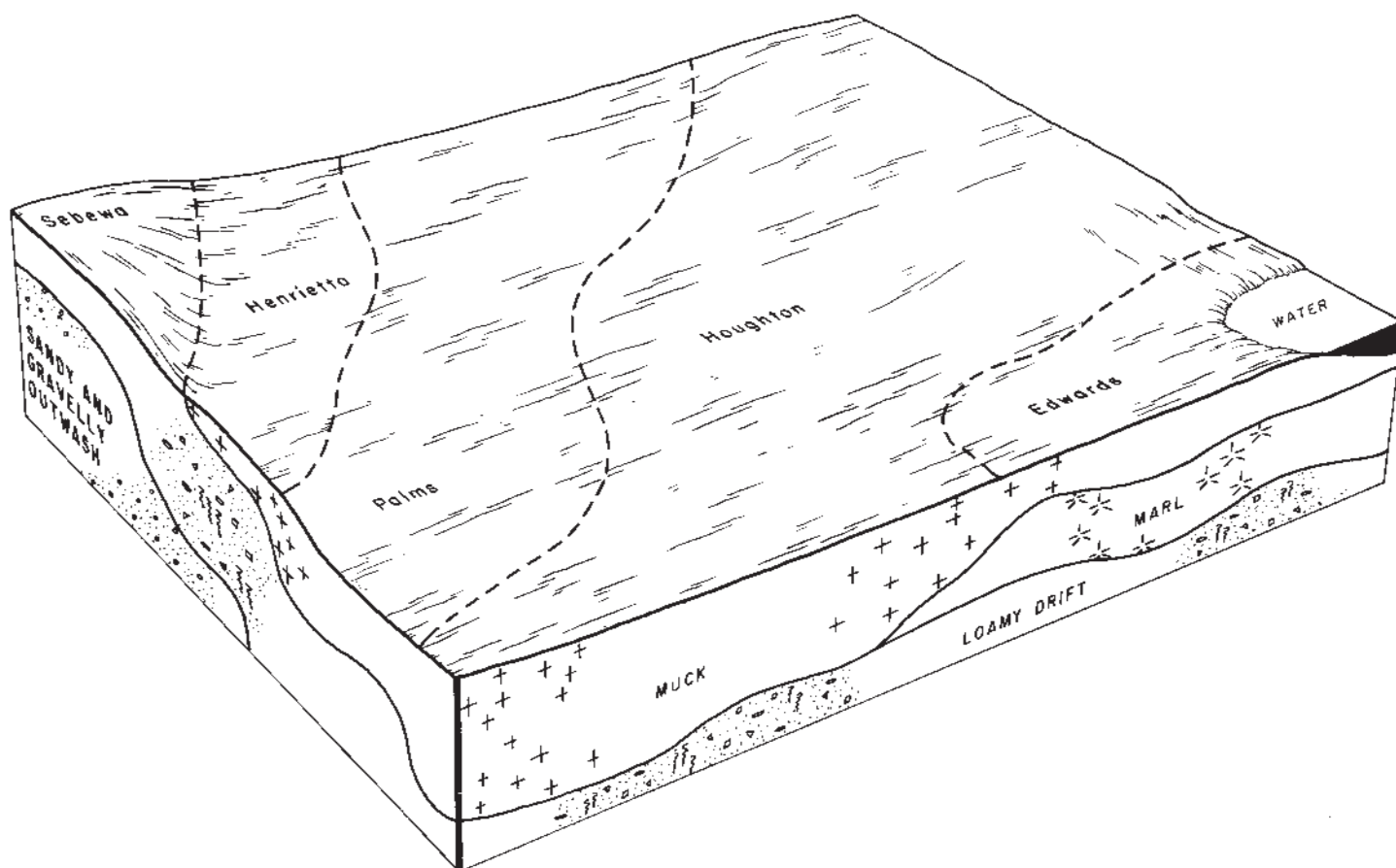


Figure 6.—Typical pattern of the soils and underlying material in the Houghton-Palms-Henrietta association.

In most of the area the soils have a cover of natural vegetation, including trees, and they are used mainly for recreation areas and as wildlife habitat. In places, they are used for cultivated crops. Specialty crops, such as lettuce, onions, mint, and sod, are the most common crops.

The soils in this association are suitable for use as cropland if adequate drainage is provided. If they are cultivated, removing excess water, preventing ponding (fig. 7), providing adequate drainage outlets, controlling soil blowing and subsidence after drainage, and overcoming equipment limitations are concerns of management. Frost action is a hazard in some areas. These soils may be deficient in nutrients, especially micronutrients, for some crops.

These soils are suitable for use as pasture and hayland if artificial drainage is provided. The ponding is a hazard to these uses. Removing excess water and preventing surface compaction are concerns of management.

The soils in this association are suited to use as woodland. Equipment limitations, plant competition,

seedling mortality, and the hazard of windthrow are concerns of management.

The use of these soils as septic tank absorption fields or for building site development is not practical. The high water table, hazard of ponding, and instability of the soil material are limitations that are extremely difficult to overcome.

broad land use considerations

The soils in Jackson County vary widely in their suitability for major land uses.

cropland

About 30 percent of the land in the county is used for cultivated crops, mainly corn and wheat. This cropland is scattered throughout the county and is concentrated in associations 1, 2, 4, 5, 6, 7, and 8. The soils in these associations are generally suited to crops.

Associations 1 and 2 are dominantly nearly level to rolling uplands. The hazards of erosion and soil blowing

are the main concerns of cropland management on the soils in these associations. In associations 4, 5, and 6, cultivated crops are grown mainly on the nearly level to rolling upland soils. The hazards of erosion and soil blowing, removing excess water during wet periods, and maintaining good soil tilth are concerns of cropland management on these soils. In associations 7 and 8, the crops are grown mainly on the nearly level to rolling, well drained upland soils. The hazards of erosion, soil blowing, and droughtiness are concerns of cropland management on these soils.

The very poorly drained organic soils in associations 5, 6, 7, and 8 are generally not cultivated. However, in some of the larger areas they have been cleared and drained and are suitable for crops, particularly specialty crops such as lettuce, celery, onions, and mint, and for sod. If these soils are cultivated, removing excess water, preventing ponding, providing adequate drainage outlets, controlling soil blowing and subsidence after drainage, and equipment limitations associated with soil stability are concerns of management. Specialty crops are also grown in some places in association 10.

pasture and hayland

About 8 percent of the land in the county is permanent pasture, and 6 percent is hayland in a tillage rotation. The soils in associations 1, 2, 4, 5, 6, 7, 8, and 9 are generally suited to use as pasture and hayland. Most of the pasture is on the rolling to very steep upland soils. Some pasture is on the soils in association 10. Pasture grasses help to control erosion.

woodland

About 25 percent of the county is in woodland. The productivity of hardwoods is high and very high on the upland soils in associations 1, 4, 5, 6, and 9 and moderately high to very high on the upland soils in associations 2, 7, and 8. It is moderately high on the soils in association 10 and on the very poorly drained organic soils in associations 5, 6, 7, 8, and 9. Plant competition is the main concern on woodland in Jackson County. Erosion, equipment limitations, seedling mortality, and windthrow hazard are additional concerns of management for some soils.

recreation

The soils are poorly suited to well suited to use as sites for recreation, depending on the intensity of the expected use. Most of the soils in associations 1, 2, 4, 5, 6, 7, and 8 are generally suited to intensive recreation uses such as playgrounds, camp areas, picnic areas, and paths and trails. Wetness is a limitation to these uses on the very poorly drained organic soils in associations 5, 6, 7, and 8 and the somewhat poorly drained upland soils in associations 4, 5, and 6. The sandy texture of the well drained soils in association 7 is also a limitation to these uses.

The soils in associations 9 and 10 are generally poorly suited to intensive recreation development. The rolling to very steep slopes in association 9 and the high water table in association 10 are limitations to this use. Most of the land area of associations 9 and 10 is within the Waterloo Recreation Area. This area is used primarily for



Figure 7.—Ponded area of the Houghton-Palms-Henrietta association.

wildlife habitat, hunting, and fishing. The soils are well suited to these uses.

wildlife habitat

The suitability of the soils for use as wildlife habitat is generally high throughout the county. The soils in associations 1, 2, 4, 5, 6, 7, 8, and 9 are generally suitable for use as habitat for openland and woodland wildlife. The nearly level to rolling, well drained organic soils in

The nearly level to rolling, well drained Hillsdale and Riddles soils in associations 1, 2, 4, and 5 are generally suited to urban uses. These soils have slight to moderate limitations for most building site development and for onsite waste disposal. Slope, shrink-swell potential, and filtering capacity are limitations to these uses.

The nearly level to rolling, well drained Marlette, Quinte, Orono, Plover, and Oshkosh soils in associations



detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. These dissimilar soils are described in each map unit. Also, some of the more unusual or strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes some *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, gravel, is an example. Some miscellaneous areas are large enough to be delineated on the soil maps. Some that are too small to be delineated are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

soil descriptions

11B—Boyer-Oshtemo sandy loams, 1 to 6 percent slopes. These are nearly level and undulating, well drained soils on broad, flat uplands and low knolls and ridges. The areas are irregular in shape and range from 2 to 500 or more acres. The Boyer soil makes up 40 to

clay loam; and in the lower part it is strong brown, loose sand and 1/8- to 1-inch-thick bands of dark brown very friable loamy sand. The substratum to a depth of about 60 inches is yellowish brown, calcareous gravelly sand. In some areas 20 or more inches of sandy material is above the gravelly sandy loam and gravelly sandy clay loam parts of the subsoil. In some areas the subsoil contains more clay.

Included in mapping are small areas of well drained Spinks soils that have more sand in the subsoil than the Boyer and Oshtemo soils. These Spinks soils are scattered throughout the complex. Also included are small areas of somewhat poorly drained Brady soils in depressions and drainageways and on foot slopes. Also included are small areas of Leoni soils that have more pebbles and cobbles in the subsoil than the Boyer and Oshtemo soils. These Leoni soils are scattered throughout the complex. The included soils make up 5 to 15 percent of the complex.

Permeability is moderately rapid in the surface layer and the subsoil and very rapid in the substratum. The available water capacity is low for the Boyer soil and moderate for the Oshtemo soil. Surface runoff is slow.

In most areas these soils are used as cropland. In a few areas they are used as pasture or woodland. These soils have good potential for use as pasture, hayland, and woodland and for recreation uses and most kinds of building site development. They have fair potential for use as cropland and poor potential for use as sites for most kinds of sanitary facilities.

If these soils are cultivated, controlling soil blowing, maintaining a high content of organic matter, and conserving soil moisture during dry periods are major concerns of management. Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control soil blowing. Returning crop residues to the soil and mulching

sites with suitable material increases the filtering capacity. Sealing the bottom and sides of sewage lagoons with impervious material can control seepage.

These soils have few limitations for building site development. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced. Lawns need a cover of loamy topsoil and need to be watered frequently to offset droughtiness. Cleared areas around construction sites should be protected from soil blowing by the use of mulch, asphalt spray, or netting or by grass seeding.

This complex is in capability subclass IIIs and Michigan soil management groups 4a and 3a.

11C—Boyer-Oshtemo sandy loams, 6 to 12 percent slopes. These are rolling, well drained soils on broad uplands consisting of ridges and knolls. The areas are irregular in shape and range from 3 to 160 or more acres. The Boyer soil makes up 40 to 55 percent of this complex, and the Oshtemo soil makes up 30 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Boyer soil has a surface layer that is dark brown sandy loam about 9 inches thick. The subsoil is dark brown and is about 23 inches thick. In the upper part it is friable sandy loam, and in the lower part it is friable gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous very gravelly sand. In some places, the subsoil contains more clay. In some areas the substratum is at a depth of less than 22 inches.

Typically, the Oshtemo soil has a surface layer that is dark brown sandy loam about 8 inches thick. The subsurface layer is yellowish brown sandy loam about 7 inches thick. The subsoil is about 20 inches thick. In the

Permeability is moderately rapid in the surface layer and the subsoil and very rapid in the substratum. The available water capacity is low for the Boyer soil and moderate for the Oshtemo soil. Surface runoff is medium.

In most areas these soils are used as cropland. In a

This complex is in capability subclass IIIe and Michigan soil management groups 4a and 3a.

11D—Boyer-Oshtemo sandy loams, 12 to 18 percent slopes. These are hilly, well drained soils on hills, ridges, and knolls. The areas are irregular in shape

matter, conserving soil moisture during dry periods, and overcoming equipment restrictions associated with slope are major concerns of management. Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control soil blowing. Cover crops, grassed waterways, and conservation tillage help to control surface runoff and erosion. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture. Farming on the contour minimizes the equipment limitations associated with slope.

The use of these soils as pasture or hayland is effective in controlling erosion. If these soils are used as pasture and hayland, the hazard of droughtiness and equipment limitations associated with slope are major concerns of management. In summer these soils often do not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing helps to maintain production during the dry months. Overgrazing during the dry months can increase the hazard of soil blowing. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion. Seeding and fertilizing on the contour minimizes the equipment limitations.

If these soils are planted to trees, plant competition is a concern of management. Intensive site preparation and

mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Boyer soils have a surface layer of dark brown sandy loam about 7 inches thick. The subsoil is dark brown and is about 20 inches thick. In the upper part it is dark brown, friable sandy loam, and in the lower part it is dark brown, friable gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous very gravelly sand. In some places, the subsoil contains more clay. In some areas the substratum is at a depth of less than 22 inches or more than 40 inches. Also in some areas the content of pebbles in the subsoil is greater than 25 percent.

Typically, the Leoni soils have a surface layer of dark brown gravelly sandy loam about 6 inches thick. The subsoil is dark brown and is about 35 inches thick. In the upper part it is firm cobbly sandy clay loam; in the middle part it is firm cobbly clay loam and gravelly clay loam; and in the lower part it is friable gravelly sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown, calcareous gravelly loamy sand.

Included in mapping are small areas of well drained Hillsdale and Spinks soils on similar positions on the landscape. The Hillsdale soils have a loamy substratum and make up about 10 percent of the complex. The Spinks soils have less clay in the subsoil than the Boyer and Leoni soils and make up about 5 percent of the complex.

Permeability in the Boyer soils is moderately rapid in

The use of these soils for building site development is limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Buildings can be designed to offset the slope. Roads and streets should be built on the contour. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced. Cleared areas around construction sites should be protected from soil erosion by the use of mulch, asphalt spray, or netting or by grass seeding.

This complex is in capability subclass VIIe and Michigan soil management groups 4a and Ga.

13B—Ormas-Spinks complex, 0 to 6 percent slopes. These are nearly level and undulating, well drained soils on broad flat uplands and on low knolls and ridges. The areas are irregular in shape and range from 3 to 500 or more acres. The Ormas soils make up 40 to 50 percent of this complex, and the Spinks soils make up 30 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Ormas soils have a surface layer that is dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown loamy sand about 10 inches thick. The subsoil is about 24 inches thick. In the upper part it is dark brown, friable sandy loam and sandy clay loam, and in the lower part it is dark brown, very friable loamy sand and gravelly sandy loam. The substratum to a depth of about 60 inches is pale brown, calcareous gravelly sand. In some areas less than 20 inches of sandy material is above the subsoil.

Typically, the Spinks soils have a surface layer of dark brown sand about 6 inches thick. The subsurface layer, about 23 inches thick, is brownish yellow and light yellowish brown sand. Below that, to a depth of about 60 inches, is light yellowish brown, loose sand and bands, 1 inch to 5 inches thick, of dark brown, friable fine sand. In some areas the combined thickness of the bands is less than 6 inches.

Included in mapping are small areas of well drained

development. The Ormas soils have good potential for recreation uses, and the Spinks soils have poor potential. These soils have fair potential for use as cropland. They have poor potential for use as sites for most kinds of sanitary facilities.

If these soils are cultivated, controlling soil blowing, maintaining a high content of organic matter, and conserving soil moisture during dry periods are major concerns of management. Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control soil blowing. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture. Irrigation should increase crop yields.

If these soils are used as pasture and hayland, droughtiness is a major concern of management. In summer these soils often do not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing helps to maintain production during the dry months. Overgrazing during the dry months increases the hazard of soil blowing.

If these soils are used as woodland, the hazard of seedling mortality is a concern of management. Plant competition also is a concern. Some seedling loss can be expected during the dry summer months. But the loss can be offset by planting more seedlings than normal and by controlling plant competition. In new tree plantations, plant competition can be controlled by such practices as disking and the use of herbicides.

The use of these soils as septic tank absorption fields or as sites for sewage lagoons is limited by a hazard of ground water pollution. The soil material is too rapidly permeable to adequately filter the effluent from septic tank absorption fields and to prevent seepage from sewage lagoons. Filling or mounding absorption field sites with suitable material increases the filtering capacity. Sealing the bottom and sides of sewage lagoons with impervious material can control seepage.

These soils have few limitations for building site development. The walls of shallow excavations tend to

small that it is not practical to separate them in mapping at the scale used.

Typically, the Ormas soils have a surface layer that is dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown loamy sand about 10 inches thick. The subsoil is about 24 inches thick. In the upper part it is dark brown, friable sandy loam and sandy clay loam, and in the lower part it is dark brown, very friable loamy sand and gravelly sandy loam. The substratum to a depth of about 60 inches is pale brown, calcareous gravelly sand. In some areas, less than 20 inches of sandy material is above the subsoil.

Typically, the Spinks soils have a surface layer that is dark brown sand about 6 inches thick. The subsurface layer is brownish yellow and light yellowish brown sand about 23 inches thick. Below that, to a depth of about 60 inches, is light yellowish brown, loose sand and bands, 1 inch to 5 inches thick, of dark brown, friable fine sand. In some places, the combined thickness of the bands is less than 6 inches.

Included in mapping are small areas of well drained Boyer and Oshtemo soils that have more clay in the surface layer and in the upper part of the subsoil than the Ormas and Spinks soils. These Boyer and Oshtemo soils are scattered throughout the complex, and they make up 5 to 15 percent of the complex. Also included are small areas of somewhat poorly drained Brady soils in depressions and drainageways and on foot slopes. They make up 5 to 10 percent of the complex.

Permeability in the Ormas soils is moderately rapid in the surface layer and the subsoil and very rapid in the substratum. Permeability in the Spinks soils is

pasture and hayland, droughtiness is a major concern of management. In summer these soils often do not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing help to maintain production during the dry months. Overgrazing during the dry months increases the hazard of soil blowing. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion.

If these soils are used as woodland (fig. 8), the hazard of seedling mortality is a concern of management. Plant competition also is a concern. Some seedling loss can be expected during the dry summer months. But the loss can be offset by planting more seedlings than normal and by controlling plant competition. Plant competition can be controlled by disking and by the use of herbicides.

If these soils are used as septic tank absorption fields, ground water pollution is a hazard. The Ormas soils are limited for this use because of slope, and the Spinks soils are limited because of inadequate filtration capacity and slope. Installing the absorption field across the slope helps to overcome the slope limitation. In areas of the Spinks soils, filling or mounding the absorption field sites with suitable material increases the filtering capacity. The Ormas and Spinks soils are generally not suited to use as sites for sewage lagoons because of the slope and the hazard of seepage.

The use of these soils for building site development is limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Roads and streets should be built on the contour. The walls of shallow excavations tend to cave in and,



Figure 8.—These trees planted in an area of Ormas-Spinks complex, 6 to 12 percent slopes, serve as a windbreak, help to control erosion, and provide habitat for wildlife.

Typically, the Spinks soils have a surface layer that is dark brown sand about 6 inches thick. The subsurface layer is brownish yellow and light yellowish brown sand about 23 inches thick. Below that, to a depth of about 60 inches, is light yellowish brown, loose sand and bands, 1 inch to 5 inches thick, of dark brown, friable fine sand. In some places the combined thickness of the bands is

Permeability in the Ormas soils is moderately rapid in the surface layer and the subsoil and very rapid in the substratum. Permeability in the Spinks soils is moderately rapid or rapid. The available water capacity is low. Surface runoff is medium.

In most areas these soils are used as pasture. In a few areas they are used as woodland or cropland. These

equipment limitations associated with slope are major concerns of management. In summer, these soils often do not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing helps to maintain production during the dry months. Overgrazing during the dry months increases the hazard of soil blowing.

good potential for use as pasture, hayland, and woodland and most kinds of building site development. It has fair potential for use as cropland. It has poor potential for use as a site for sewage lagoons, and for use as septic tank absorption fields, and for recreation

of dark brown, friable fine sand. In some pedons the bands do not occur or have a combined thickness of less than 6 inches.

Included in mapping are small areas of well drained Ormas and Oshtemo soils that have more clay in the subsoil than the Spinks soil. These soils are scattered throughout the map unit, and they make up about 5 to 15 percent of the unit. Also included are small areas of somewhat poorly drained Brady soils in depressions and drainageways and on foot slopes. They make up about 5 percent of the map unit.

Permeability is moderately rapid or rapid. The available water capacity is low. Surface runoff is medium.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as pasture and woodland. It has fair potential for use as cropland and for building site development. It has poor potential for use as a site for sewage lagoons, and for use as septic tank absorption fields, and for recreation uses.

If this soil is cultivated, controlling soil blowing and water erosion, maintaining a high content of organic matter, and conserving soil moisture during dry periods are major concerns of management. Tree windbreaks,

overcome by shaping the site and by using retaining walls. Roads and streets should be built on the contour. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced. Lawns need a cover of loamy topsoil and need to be watered frequently to offset droughtiness. Cleared areas around construction sites should be protected from soil blowing by the use of mulch, asphalt spray, or netting or by grass seeding.

This map unit is in capability subclass IIIe and Michigan soil management group 4a.

14D—Spinks sand, 12 to 25 percent slopes. This is a hilly and steep, well drained soil on hills and high ridges and knolls. The areas are irregular in shape and range from 3 to 100 or more acres.

Typically, the surface layer is dark brown sand about 6 inches thick. The subsurface layer is brownish yellow and light yellowish brown sand about 23 inches thick. Below that, to a depth of about 60 inches, is light yellowish brown, loose sand and bands, 1 inch to 5 inches thick, of dark brown, friable fine sand. In some places the bands are absent or have a combined thickness of less than 6 inches.

Included in mapping are small areas of well drained

normal. On the steeper slopes, erosion is a hazard and the use of heavy equipment for planting, tending, and harvesting trees is restricted. Constructing logging roads and skid trails on the gentler slopes helps to prevent erosion and to overcome the equipment limitations.

This soil is generally not suitable for use as a site for sewage lagoons and for use as septic tank absorption fields because of the steepness of slope.

The use of this soil for building site development is

concerns of management. Combined surface and subsurface drainage systems help to control wetness. Shallow surface ditches are effective in removing surface water from low areas after heavy rains. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil. Working this soil when it is wet

limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Buildings can be designed to offset the slope.

may result in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

Included in mapping are small areas of very poorly drained Gilford soils in depressional areas. These soils make up about 5 to 10 percent of the map unit. Also included are small areas of well drained Boyer, Oshtemo, and Spinks soils. These soils are on ridgetops and knolls, and they make up about 5 to 15 percent of the map unit.

Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. The available water capacity is moderate. Surface runoff is slow. The high water table is at a depth of 1 to 3 feet from November to May.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as cropland, pasture, and hayland. It has fair potential for use as woodland. It has poor potential for most recreation uses, for use as a site for sanitary facilities, and for building site development.

If this soil is cultivated, removing excess water during wet periods, controlling soil blowing, and maintaining a high content of organic matter and good tilth are major concerns of management. Combined surface and subsurface drainage systems help to control wetness. Shallow surface ditches are effective in removing surface water from low areas after heavy rains. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Open ditches are difficult to maintain and tile is difficult to install because cutbanks cave in. Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control soil blowing. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter. Working this soil when it is wet may result in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

suitable base material. The included Boyer, Oshtemo, and Spinks soils are better suited to building site development because they are better drained.

This map unit is in capability subclass IIw and Michigan soil management group 3b.

17—Barry loam. This is a nearly level, poorly drained soil in broad, flat areas and in depressions and drainageways. It is subject to frequent ponding. The areas of this map unit are irregular or elongated in shape and range from 3 to 100 or more acres.

Typically, the surface layer is black loam about 10 inches thick. The subsoil is mottled and is about 20 inches thick. In the upper part it is dark olive gray, friable loam; in the middle part it is dark gray and olive, firm and friable sandy clay loam; and in the lower part it is olive, very friable sandy loam. The substratum to a depth of about 60 inches is grayish brown and calcareous. It is sandy loam in the upper 14 inches and loamy sand in the lower 16 inches. In some places, the surface layer is less than 10 inches thick. In some places, the subsoil contains less clay. Also in some places, the substratum is stratified sandy, loamy, and silty material or sand and gravelly sand.

Included in mapping are small areas of somewhat poorly drained Teasdale soils on low knolls and ridges. These soils make up 10 to 15 percent of the map unit. Also included are small areas of very poorly drained Palms soil that are on slightly lower positions on the landscape and make up about 5 percent of the map unit.

Permeability is moderate. The available water capacity is high. Surface runoff is slow. This soil has a high water table near or above the surface from November to May.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as cropland, pasture, and hayland.

it is wet can cause surface compaction and destroy forage plants. Proper stocking rates, rotation grazing or strip grazing, and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If this soil is used as woodland, equipment limitations and plant competition are major concerns of management. The use of heavy equipment for planting, tending, and harvesting trees is restricted during wet periods. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs. The hazards of seedling mortality and windthrow also are concerns of management. Seedling loss may be high because of wetness. But the loss can be offset by planting more seedlings than normal and by controlling plant competition. To minimize windthrow damage, stands should be thinned only slightly; mature stands can be clear cut.

This soil is generally not suited to use as septic tank absorption fields, to use as a site for sewage lagoons, and to building site development because of the hazard of ponding.

This map unit is in capability subclass IIw and Michigan soil management group 3c.

18—Gilford-Colwood complex. This complex consists of nearly level, very poorly drained Gilford soils and poorly drained Colwood soils in broad flat areas and in depressions and drainageways. These soils are subject to frequent ponding. The areas of this complex are irregular or elongated in shape and range from 3 to 200 or more acres. The Gilford soils make up 40 to 55 percent of this complex, and the Colwood soils make up 30 to 45 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Gilford soils have a surface layer that is black fine sandy loam about 11 inches thick. The subsoil is grayish brown and mottled and is about 24 inches thick. In the upper part it is friable fine sandy loam; in the middle part it is friable loam; and in the lower part it is stratified grayish brown, very friable fine sandy loam and yellowish brown, loose loamy sand. The substratum to a depth of about 60 inches is mottled and consists of stratified grayish brown sandy loam, loamy sand, and sand in the upper 15 inches and light olive brown, calcareous sand in the lower 10 inches. In some places, the subsoil contains more clay. In some places, the substratum is at a depth of more than 40 inches.

Typically, in the Colwood soil the surface and subsurface layers combined are about 12 inches thick. The surface layer is very dark gray silt loam, and the subsurface layer is very dark gray, mottled very fine sandy loam. The subsoil is mottled and is about 21 inches thick. In the upper part it is dark grayish brown, friable very fine sandy loam; in the middle part it is light olive brown, friable loam; and in the lower part it is stratified olive and brownish yellow, friable loamy fine

sand, loamy very fine sand, fine sandy loam, and firm clay loam. The substratum to a depth of about 60 inches is stratified gray and light olive brown, mottled, calcareous fine sand, loamy fine sand, silt loam, and silty clay loam. In some places the substratum is sand or gravelly sand.

Included in mapping are small areas of somewhat poorly drained Dixboro and Kibbie soils on low knolls and ridges. They make up 5 to 10 percent of the map unit. Also included are small areas of very poorly drained Henrietta soils that have a surface layer of muck. They are on slightly lower positions on the landscape than the Gilford and Colwood soils, and they make up 5 to 10 percent of the map unit.

Permeability in the Gilford soils is moderately rapid in the subsoil and rapid in the substratum. Permeability in the Colwood soils is moderate. The available water capacity is moderate for the Gilford soils and high for the Colwood soils. Surface runoff is very slow or ponded. These soils have a seasonal high water table near or above the surface from December to May.

In most areas these soils are used as cropland. In a few areas they are used as pasture or woodland. These soils have good potential for use as cropland, pasture, and hayland. They have poor potential for woodland use, for recreation uses, for use as sites for sanitary facilities, and for building site development.

If these soils are cultivated, removing excess water, providing adequate drainage outlets, and maintaining good soil tilth are major concerns of management. Controlling soil blowing is an additional concern on the Gilford soils. Artificial drainage is needed for optimum crop yields. Combined surface and subsurface drainage systems help to control wetness. Shallow surface ditches are effective in removing surface water from low areas after heavy rains. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Open ditches are difficult to maintain and tile is difficult to install because cutbanks cave. Tile lines should be protected with a suitable material to prevent their filling with fine sand. Lift pumps may be needed at the outlet in some areas. Tree windbreaks, buffer strips, and conservation tillage help to control soil blowing on the Gilford soils. Working these soils when they are wet results in compaction and the formation of clods. Conservation tillage, cover crops, crop residue returned to the soil, and regular additions of other organic matter help to maintain good soil tilth.

If these soils are used as pasture and hayland, excess water and surface compaction are the major concerns of management. Pasture plant species that are tolerant of wetness should be selected. Overgrazing or grazing when these soils are too wet can cause surface compaction and destroy forage plants. Proper stocking rates, rotation grazing or strip grazing, and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If these soils are used as woodland, equipment limitations and plant competition are major concerns of

management. The use of heavy equipment for planting, tending, and harvesting trees is restricted during the wet periods. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs. The hazards of seedling mortality and windthrow also are concerns of management. Seedling loss may be high because of wetness. But the loss can be offset by planting more seedlings than normal and by controlling plant competition. To minimize windthrow damage, stands should be thinned only slightly; mature stands can be clear cut.

These soils are generally not suited to use as septic tank absorption fields, to use as sites for sewage lagoons, and to building site development because of the hazard of ponding.

This complex is in capability subclass 1lw and Michigan soil management groups 4c and 2.5c-s.

20—Houghton muck. This is a nearly level, very poorly drained soil in bogs, depressions, and drainageways and along the edge of lakes. This soil is subject to frequent ponding. The areas are irregular in shape and range from 3 to 500 or more acres.

Typically, the surface layer is black muck about 10 inches thick. The underlying layers to a depth of about 60 inches are black muck. In some places, there is more than 1 inch of sedimentary peat within 51 inches of the surface. In some places, there is more than 10 inches of

this soil is drained, soil blowing is a hazard. Tree windbreaks, buffer strips, and cover crops help to control the soil blowing. Controlled drainage improves soil stability and reduces subsidence. This soil needs to be tested for nutrient deficiencies. Fertilizer may be needed.

If this soil is used as pasture and hayland, excess water and surface compaction are the major concerns of management. Grazing when this soil is too wet can cause surface compaction and destroy forage plants. Proper stocking rates and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If this soil is used as woodland, equipment limitations and plant competition are major concerns of management. The use of heavy equipment for planting, tending, and harvesting trees is restricted because of wetness and the low stability of the soil material. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs. The severe hazards of seedling mortality and windthrow also are concerns of management. Seedling losses may be high because of wetness. But this loss can be offset by planting more seedlings than normal and by controlling plant competition. To minimize windthrow damage, intermediate and regeneration cuts should be carefully planned to give maximum protection from the wind.

This soil is not suited to use as a site for sanitary facilities or to building site development because of the high water table, the hazard of ponding, and the

ponded. This soil has a high water table 1 foot or less below the surface from September to May.

In most areas this soil is used as woodland or wetland. In few areas it is used as pasture. It has fair potential for use as woodland. It has poor potential for use as cropland, pasture, and hayland, for recreation uses, for use as a site for sanitary facilities, and for building site development.

Crop production is usually not economically practical on this soil because of the frequent flooding. If this soil is cultivated, removing excess water, preventing flooding, controlling soil blowing, maintaining good soil tilth, and overcoming equipment limitations associated with wetness are major concerns of management. Frost action is a hazard in some areas.

If this soil is used as pasture and hayland, excess water and surface compaction are the major concerns of management. Only pasture plant species that are tolerant of wetness should be selected. Overgrazing or grazing when this soil is too wet can cause surface compaction and destroy forage plants. Proper stocking rates, rotation grazing or strip grazing, and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If this soil is used as woodland, equipment limitations

inches is stratified brown and light olive brown, mottled, calcareous very fine sandy loam, fine sand, and silt loam. In some places, the surface layer is darker. In some areas the subsoil contains less clay.

Included in mapping are small areas of very poorly drained Gilford soils and poorly drained Colwood soils in depressions and drainageways. These included soils make up 5 to 15 percent of the map unit.

Permeability is moderate. The available water capacity is high. Surface runoff is slow. This soil has a high water table at a depth of 1 to 2 feet from November to May.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as cropland, pasture, hayland, and woodland. It has fair potential for recreation uses. It has poor potential for use as a site for sanitary facilities and for building site development.

If this soil is cultivated, removing excess water during wet periods and maintaining a high content of organic matter and good soil tilth are major concerns of management. Combined surface and subsurface drainage systems help to control wetness. Shallow surface ditches are effective in removing surface water from low areas after heavy rains. Erosion-control structures may be needed at the outlet of surface

There will be no other witnesses.

tending and harvesting trees is severely restricted

2000

In most areas these soils are used as cropland. In a few areas they are used as pasture or woodland. These soils have good potential for use as pasture, hayland, woodland, and septic tank absorption fields and for most kinds of building site development uses. They have fair potential for use as cropland and for recreation uses. They have poor potential for use as sites for sewage lagoons.

If these soils are cultivated, controlling soil blowing, maintaining a high content of organic matter, and conserving soil moisture during dry periods are major concerns of management. A hazard of erosion is an additional concern on the Arkport soil. Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control soil blowing. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture. Irrigation should increase crop yields. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff and erosion on the Arkport soil.

If these soils are used as pasture and hayland, the hazard of droughtiness is a major concern of management. In summer these soils often do not have

Typically, the Arkport soils have a surface layer that is dark brown loamy fine sand about 7 inches thick. The subsurface layer is about 54 inches thick. It consists of yellowish brown, loose loamy fine sand and bands, 1/8 inch to 6 inches thick, of strong brown, friable fine sandy loam. The substratum to a depth of about 65 inches is stratified, yellowish brown, calcareous fine sand and very fine sand. In some areas the bands are sand or loamy sand.

Typically, the Okee soils have a surface layer that is dark brown loamy fine sand about 7 inches thick. The subsurface layer, about 16 inches thick, is yellowish brown loamy fine sand. The subsoil is about 34 inches thick. In the upper part it is yellowish brown, very friable loamy fine sand; in the middle part it is yellowish brown, friable sandy loam; and in the lower part it is dark brown, very friable loamy sand. The substratum to a depth of about 66 inches is yellowish brown, calcareous sandy loam. In some areas there is less than 20 inches of loamy fine sand above the subsoil. In some places, the subsoil contains more clay. In some areas the substratum consists of sand and gravel.

Included in mapping are small areas of well drained Boyer and Oshtemo soils that have more clay in the surface soil and in the upper part of the subsoil than the

If these soils are used as pasture and hayland, the hazards of droughtiness and water erosion are major concerns of management. In summer these soils often do not have sufficient moisture for optimum plant growth. Deep-rooted, drought-resistant plant species should, therefore, be selected. Rotation grazing or strip grazing helps to maintain production during the dry periods. Overgrazing during the dry periods increases the hazard of soil blowing. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion.

If these soils are used as woodland, plant competition and seedling mortality are concerns of management. Intensive site preparation and herbicides help to control the growth of undesirable vegetation.

The use of these soils as septic tank absorption fields is limited by slope. Ground water pollution is a hazard. Filling or mounding the absorption field site with suitable material increases the filtering capacity of the soils. Installing the absorption field across the slope helps to overcome the slope limitation. These soils are generally not suited to use as sites for sewage lagoons because of the slope and a hazard of seepage.

The use of these soils for building site development is limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Roads and streets should be built on the contour. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced. Lawns need a cover of loamy topsoil and need to be watered frequently to offset droughtiness. Cleared areas around construction sites should be protected from soil erosion by the use of mulch, asphalt spray, or netting or by grass seeding.

This complex is in capability subclass IIIe and Michigan soil management groups 3a-s and 4/2a.

35D—Arkport-Okee loamy fine sands, 12 to 25 percent slopes. These are hilly and steep, well drained soils on hills and high ridges and knolls. The areas are

thick. In the upper part it is yellowish brown, very friable loamy sand; in the middle part it is yellowish brown, friable sandy loam; and in the lower part it is dark brown, very friable loamy sand. The substratum to a depth of about 66 inches is yellowish brown, calcareous sandy loam. In some areas there is less than 20 inches of loamy fine sand above the subsoil. In some places, the substratum consists of sand and gravel. In some places, the subsoil contains more clay.

Included in mapping are small areas of well drained Boyer and Oshtemo soils, which have more clay in the surface soil and in upper part of the subsoil than the Arkport and Okee soils. These Boyer and Oshtemo soils are scattered throughout the complex, and they make up 5 to 10 percent of the complex. Also included are small areas of somewhat poorly drained Dixboro soils in depressions and drainageways and on foot slopes. These soils make up about 5 percent of the complex.

Permeability in the Arkport soils is moderately rapid. Permeability in the Okee soils is moderately rapid in the surface and subsurface layers and moderate in the subsoil and the substratum. The available water capacity is low for the Arkport soils and moderate for the Okee soils. Surface runoff is rapid.

In most areas these soils are used as pasture. In a few areas they are used as woodland or cropland. In some places these soils are used as a source of sand. These soils have good potential for use as pasture, hayland, and woodland. They have poor potential for use as cropland, for recreation uses, for use as sites for sanitary facilities, and for building site development.

If these soils are cultivated, controlling soil blowing and water erosion, maintaining a high content of organic matter, conserving soil moisture during dry periods, and overcoming equipment limitations associated with slope are major concerns of management. Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control soil blowing. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to

runoff and erosion. Seeding and fertilizing on the contour minimize the equipment limitations.

If these soils are used as woodland, plant competition and equipment limitations are the major concerns of management. Plant competition is a severe problem on the Okee soil. The use of heavy equipment for planting, tending, and harvesting trees is restricted because of the

In most areas this soil has a cover of natural vegetation, including trees. In some areas it is drained, generally for truck and specialty crops. In a few areas it is used as pasture. This soil has good potential for truck and specialty crops and for pasture and hay crops. It has poor potential for use as habitat for woodland wildlife, for recreation uses, for use as a site for sanitary facilities

more acres. The Ypsi soils make up 40 to 60 percent of this complex, and the Wauseon soils make up 20 to 40 percent. The areas of these soils are so intricately mixed together that it is not practical to separate them in

crop yields. Combined surface and subsurface drainage systems help to control wetness. Shallow surface ditches are effective in removing surface water from low areas after heavy rains. Erosion-control structures may

is about 29 inches thick. In the upper part it is grayish brown, firm silty clay loam; and in the lower part it is gray silty clay loam and thin strata of very fine sand and silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, stratified, calcareous silt loam, silty clay loam, and very fine sand. In some areas the surface layer is greater than 10 inches thick. In some areas the subsoil contains less clay. Also, in some areas the substratum is sand, gravelly sand, or sandy loam and loamy sand.

Included in mapping are small areas of somewhat poorly drained Del Rey soils on low knolls and ridges. These soils make up from 10 to 15 percent of the map unit. Also included are small areas of very poorly drained Palms soils that have organic horizons 16 to 51 inches thick. These soils are on slightly lower positions on the landscape than the Lenawee soil, and they make up about 5 percent of the map unit.

Permeability is moderately slow. The available water capacity is high. Surface runoff is very slow or ponded. This soil has a high water table near or above the surface from January to May.

In most areas this soil is used as woodland. In a few areas it is used as pasture or cropland. This soil has good potential for use as cropland, pasture, hayland, and woodland. It has poor potential for recreation uses, for use as a site for sanitary facilities, and for building site development.

If this soil is cultivated, removing excess water, providing adequate drainage outlets, and maintaining good soil tilth are major concerns of management. The hazard of ponding is also a concern in some areas. Artificial drainage is needed for optimum crop yields. Combined surface and subsurface drainage systems help to control wetness. Shallow surface ditches are effective in removing surface water from low areas after heavy rains. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Lift pumps may be needed at the outlet in some areas. Working this soil when it is too wet results in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

If this soil is used as pasture and hayland, excess water and surface compaction are the major concerns of management. Ponding is a hazard in some areas. Pasture plant species that are tolerant of wetness should be selected. Overgrazing or grazing when this soil is too wet can cause surface compaction and destroy forage plants. Proper stocking rates, rotation grazing or strip grazing, and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If this soil is used as woodland, equipment limitations and plant competition are major concerns of management. The use of heavy equipment for planting, tending, and harvesting trees is restricted during wet periods. Intensive site preparation and herbicides help to

control the growth of undesirable trees and shrubs. The hazards of seedling mortality and windthrow also are concerns of management. Seedling loss may be high because of the wetness. But the loss can be offset by planting more seedlings than normal and by controlling plant competition. To minimize windthrow damage, intermediate and harvest cuts should be carefully planned to give maximum protection from the wind.

This soil is generally not suited to use as septic tank absorption fields, to use as a site for sewage lagoons, and to building site development because of the hazard of ponding.

This map unit is in capability subclass IIw and Michigan soil management group 1.5c.

42A—Riddles sandy loam, 0 to 2 percent slopes.

This is a nearly level, well drained soil on broad, flat uplands. The areas are irregular in shape and range from 3 to 100 or more acres.

Typically, the surface layer is dark brown sandy loam about 9 inches thick. The subsurface layer is yellowish brown sandy loam about 4 inches thick. The subsoil is about 41 inches thick. In the upper part it is yellowish brown, firm sandy clay loam and clay loam; in the middle part it is dark yellowish brown, friable sandy clay loam; and in the lower part it is yellowish brown, friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous sandy loam. In some areas the subsoil contains less clay. In some areas the substratum is at a depth of less than 40 inches, and in some areas the substratum is gravelly sand. In some places, the surface layer is loamy sand.

Included in mapping are small areas of somewhat poorly drained Teasdale soils in depressions and drainageways. These soils make up about 5 to 10 percent of the map unit. Also included are small areas of well drained Arkport and Okee soils that have more sand in the subsoil than the Riddles soil. These soils are scattered throughout the map unit, and they make up about 5 percent of the unit.

Permeability is moderate. The available water capacity is moderate. Surface runoff is slow.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as cropland, pasture, hayland, woodland, for recreation uses, and for use as septic tank absorption fields. It has fair potential for use as a site for sewage lagoons and for building site development.

If this soil is cultivated, maintaining a high content of organic matter and good soil tilth are major concerns of management. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter. Working this soil when it is too wet results in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

If this soil is used as woodland, plant competition is a concern of management. Intensive site preparation and

herbicides help to control the growth of undesirable trees and shrubs.

This soil is suited to use as septic tank absorption fields. The use of this soil as a site for sewage lagoons is limited by the hazard of seepage. Sealing the bottom and sides of sewage lagoons with impervious material can control the seepage.

The use of this soil for building site development is limited by the shrinking and swelling of the soil. Replacing the upper layers of the soil with suitable material can control the shrinking and swelling.

This map unit is in capability class I and Michigan soil management group 2.5a.

42B—Riddles sandy loam, 2 to 6 percent slopes.

This is an undulating, well drained soil on broad, nearly flat uplands and on low ridges and knolls. The areas are

increase the content of organic matter. Cover crops, grassed waterways, and conservation tillage used in a tillage crop rotation help to control surface runoff and erosion. Working this soil when it is too wet results in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

The use of this soil as pasture or hayland is effective in controlling erosion. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion.

If this soil is used as woodland, plant competition is a concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

This soil is suited to use as septic tank absorption fields. The use of this soil as a site for sewage lagoons is limited by slope and the hazard of seepage.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has good potential for use as pasture, hayland, and woodland. It has fair potential for use as cropland, for most recreation uses, for use as septic tank absorption fields, and for most kinds of building site development.

vegetative cover by preventing overgrazing helps to control surface runoff and erosion.

If this soil is used as woodland, plant competition is a concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees



protected from erosion by the use of mulch, asphalt spray, or netting or by grass seeding.

This map unit is in capability subclass IIIe and Michigan soil management group 2.5a.

42D—Riddles sandy loam, 12 to 18 percent slopes.

This is a hilly, well drained soil on ridges and high knolls. The areas are irregular in shape and range from 3 to 60

The use of this soil as pasture or hayland is effective in controlling erosion. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion.

If this soil is used as woodland, plant competition is a concern of management. Intensive site preparation and herbicides help to control the growth of unwanted trees and shrubs.

This soil is generally not suitable for use as a site for ~~landfills~~ and for use as septic tank absorption

woodland. It has poor potential for most recreation uses, for use as a site for sanitary facilities, and for building site development.

If this soil is cultivated, removing excess water during wet periods, controlling soil blowing, and maintaining a high content of organic matter and good soil tilth are major concerns of management. Combined surface and subsurface drainage systems help to control wetness. Shallow surface ditches are effective in removing surface water from low areas after heavy rains. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Open ditches are difficult to maintain and tile is difficult to install because cutbanks cave in. Tile lines should be protected with a suitable material to prevent their filling with fine sand. Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control soil blowing. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter. Working this soil when it is too wet may result in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

If this soil is used as pasture and hayland, excess water and surface compaction are the major concerns of

management. The subsoil is dark brown and is about 29 inches thick. In the upper part it is firm gravelly sandy clay loam, and in the lower part it is firm and friable gravelly sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown, calcareous very gravelly loamy sand.

Included in mapping are small areas of somewhat poorly drained Brady soils in depressions and drainageways. These soils make up about 5 percent of the map unit. Also included are small areas of well drained Ormas soils that have fewer cobbles and pebbles and more sand in the subsoil than the Leoni soil. These soils are scattered throughout the map unit, and they make up about 5 percent of the unit.

Permeability is moderate in the surface layer and the subsoil and rapid or moderately rapid in the substratum. The available water capacity is low. Surface runoff is slow.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has a good potential for use as pasture, hayland, and woodland. It has fair potential for use as cropland, for most recreation uses, and for most kinds of building site development. It has poor potential for use as a site for sewage lagoons and for use as septic tank absorption

management. Overgrazing or grazing on this soil when it

fields.

This map unit is in capability subclass IIIs and Michigan soil management group Ga.

44C—Leoni gravelly sandy loam, 6 to 12 percent slopes. This is a rolling, well drained soil on broad uplands consisting of ridges and knolls. The areas are irregular in shape and range from 3 to 100 or more acres.

Typically, the surface layer is very dark grayish brown gravelly sandy loam about 11 inches thick. The subsurface layer is brown gravelly sandy loam about 2 inches thick. The subsoil is dark brown and is about 29 inches thick. In the upper part it is firm gravelly sandy clay loam, and in the lower part it is friable and firm gravelly sandy loam in which the content of cobblestones is about 10 percent. The substratum to a depth of about 60 inches is dark yellowish brown, calcareous very gravelly loamy sand. In some areas the subsoil is less than 35 percent pebbles and cobbles.

Included in mapping are small areas of somewhat poorly drained Brady soils in depressions and drainageways. These soils make up about 5 percent of the map unit. Also included are small areas of well drained Ormas soils that have fewer pebbles and cobbles and more sand in the subsoil than the Leoni soil. These soils are scattered throughout the map unit,

of management. In summer this soil often does not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing helps to maintain production during the dry periods. Maintaining an adequate vegetative cover by preventing overgrazing helps to control erosion.

The use of this soil as septic tank absorption fields is limited by slope. Installing the absorption field across the slope helps to overcome this limitation. This soil is generally not suited to use as a site for sewage lagoons because of slope.

The use of this soil for building site development is limited by large stones, by the shrinking and swelling of the soil, and by slope. The large stones may need to be removed from some sites. The shrinking and swelling can be controlled by replacing the upper layers of the soil with suitable material. For buildings, the slope limitation can be overcome by shaping the site and by using retaining walls. Buildings can be designed to offset the slope. Roads and streets should be built on the contour. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced.

This map unit is in capability subclass IIIe and Michigan soil management group Ga.

44D—Leoni gravelly sandy loam, 12 to 18 percent

equipment limitations associated with slope and the high cobble content are concerns of management. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff and erosion. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture.

The use of this soil as pasture or hayland is effective in controlling erosion. If this soil is used as pasture and hayland, the hazard of droughtiness is a major concern of management. Equipment limitations associated with slope are also a major concern. In summer this soil often does not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing helps to maintain production during the dry periods. Maintaining an adequate vegetative cover by preventing overgrazing helps to control erosion. Seeding and fertilizing on the contour minimize the equipment limitations.

This soil is generally not suitable for use as a site for sewage lagoons and for use as septic tank absorption fields because of slope.

The use of this soil for building site development is limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Buildings can be designed to offset the slope. Roads and streets should be built on the contour. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced. Cleared areas around construction sites should be protected from soil erosion by the use of mulch, asphalt spray, or netting or by grass seeding.

This map unit is in capability subclass IVe and Michigan soil management group Ga.

45—Martisco muck. This is a nearly level, very poorly drained soil in bogs, depressions, and drainageways and along the edges of lakes. This soil is subject to frequent ponding. The areas are irregular in shape and range from 3 to 100 or more acres.

Typically, the surface layer is black muck about 8 inches thick. The substratum to a depth of about 60 inches is mottled, white and gray marl. In some areas the mucky surface layer is less than 8 inches thick, and in some areas it is more than 16 inches thick. In some areas the substratum is loamy or sandy material.

pH and may, therefore, be deficient in some of the micronutrients needed by certain crops.

In most areas this soil has a cover of natural vegetation, including trees. In some areas the soil is drained, generally for truck and specialty crops. In a few areas it is used as pasture. This soil has good potential for truck and specialty crops and for pasture and hay crops. It has poor potential for woodland use, for recreation uses, for use as a site for sanitary facilities, and for building site development.

If this soil is cultivated, removing excess water, preventing ponding, providing adequate drainage outlets, controlling soil blowing and subsidence after drainage, and overcoming equipment limitations associated with soil stability are major concerns of management. Frost action is a hazard in some areas. Artificial drainage is needed for crop production. Lift pumps may be needed at the drainage outlet in some areas. If this soil is drained, soil blowing is a hazard. Tree windbreaks, buffer strips, and cover crops help to control soil blowing. Controlled drainage improves soil stability and reduces subsidence. This soil needs to be tested for nutrient deficiencies. Fertilization may be needed.

If this soil is used as pasture and hayland, excess water and surface compaction are the major concerns of management. Grazing when the soil is too wet will cause surface compaction and destroy forage plants. Proper stocking rates and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

Commercial wood production is generally not economically practical on this soil. Trees grow slowly because of the high water table. In many areas only shrubs grow. The use of heavy equipment for planting, tending, and harvesting trees is severely restricted because of the wetness. Plant competition, seedling mortality, and windthrow are severe hazards.

This soil is not suited to use as a site for sanitary facilities and to building site development because of the high water table, the hazard of ponding, and the instability of the soil material. These limitations are extremely difficult to overcome.

This map unit is in capability subclass IVw and Michigan soil management group M/mc.

46—Sebewa loam. This is a nearly level, poorly

substratum is stratified sandy, loamy, and silty material or is loamy throughout.

Included in mapping are small areas of somewhat poorly drained Brady soils on low ridges and knolls. These soils make up about 5 to 10 percent of the map unit. Also included are small areas of very poorly drained Henrietta soils that have a surface layer of muck. These soils are on slightly lower positions on the landscape than the Sebewa soil, and they make up about 5 percent of the map unit.

Permeability is moderate in the surface and subsurface layers and the subsoil and rapid in the substratum. The available water capacity is moderate. Surface runoff is very slow or ponded. This soil has a high water table at or above the surface from September to May.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has

This soil generally is not suited to use as septic tank absorption fields, to use as a site for sewage lagoons, and to building site development because of the hazard of ponding.

This map unit is in capability subclass IIw and Michigan soil management group 3/5c.

47—Histosols and Aquents, ponded. This map unit consists of nearly level, very poorly drained organic soils and very poorly drained sandy or loamy soils. These soils are in marsh areas, most of which are always flooded. The areas are irregular or circular in shape and range from 3 to 250 or more acres. The Histosols make up 60 to 80 percent of this map unit, and the Aquents make up 0 to 30 percent.

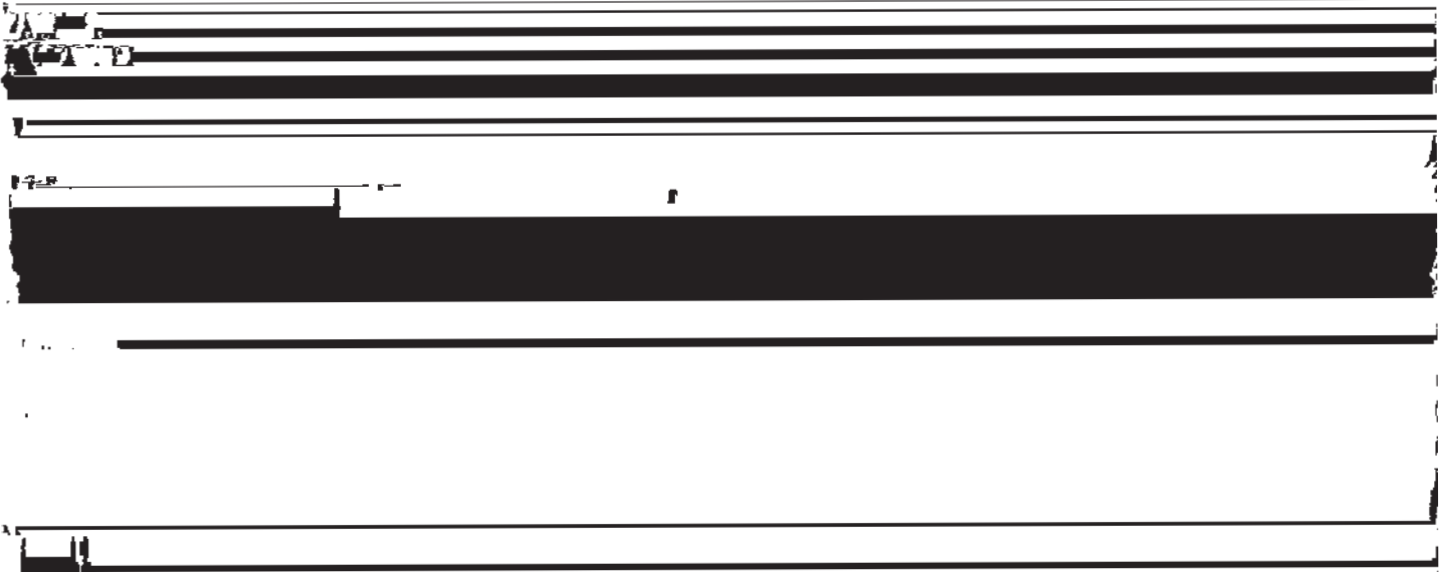
These soils vary greatly in some important properties, especially texture.

Included in mapping are small areas of open water

near or above the surface from September to June. The low pH of this organic soil may cause a deficiency of some micronutrients in certain crops.

In most areas this soil has a cover of natural vegetation, including trees. General cultivated crops are seldom grown because of the wetness and the stability of the soil material.

tending, and harvesting trees is restricted because of the wetness and the stability of the soil material. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs. The severe hazards of seedling mortality and windthrow also are



make up 45 to 65 percent of this complex, and the Riddles soils make up 20 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Hillsdale soil has a surface layer that is dark grayish brown sandy loam about 10 inches thick. The subsurface layer is dark yellowish brown sandy loam about 5 inches thick. The subsoil is about 48 inches thick. In the upper part it is dark yellowish brown, friable sandy loam; in the middle part it is dark brown and dark yellowish brown, firm sandy loam; and in the lower part it is dark yellowish brown and yellowish brown, friable sandy loam. The substratum to a depth of about 66 inches is yellowish brown, calcareous sandy loam.

Typically, the Riddles soil has a surface layer that is dark brown sandy loam about 9 inches thick. The subsurface layer is yellowish brown sandy loam about 4

and conservation tillage used in a crop rotation help to control surface runoff and erosion. Returning crop residue to the soil and regularly adding of other organic matter help to maintain or increase the content of organic matter.

The use of these soils as pasture and hayland is effective in controlling erosion. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff.

If these soils are used as woodland, plant competition is a concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

These soils are suited to use as septic tank absorption fields. The use of these soils as sites for sewage lagoons is limited by the hazard of seepage and by slope. Sealing the bottom and sides of sewage lagoons with impervious material can control seepage.

Conservation tillage helps to overcome the slope limitation

Included in mapping are small areas of well drained Spinks and Arkport soils that have more sand in the subsoil than the Hillsdale and Riddles soils. These Spinks and Arkport soils are scattered throughout the complex, and they make up about 5 to 20 percent of the complex. Also included are small areas of somewhat

49D—Hillsdale-Riddles sandy loams, 12 to 18 percent slopes. These are hilly, well drained soils on hills, ridges, and knolls. The areas are irregular in shape and range from 3 to more than 100 acres. The Hillsdale soil makes up 45 to 65 percent of this complex, and the Riddles soil makes up 35 to 45 percent. The areas of

poorly drained Teasdale soils in depressions and drainageways. These soils make up about 5 percent of the complex. Also included are small areas of well drained Leoni soils that have more pebbles and cobbles in the subsoil than the Hillsdale and Riddles soils. These Leoni soils are scattered throughout the complex, and they make up about 5 percent of the complex.

Permeability is moderate. The available water capacity is moderate. Surface runoff is medium.

In most areas these soils are used as cropland. In a few areas they are used as pasture or woodland. They have good potential for use as pasture, hayland, and

these soils are so intricately mixed or are so small that it is not practical to separate them in mapping at the scale used.

Typically, the Hillsdale soil has a surface layer that is dark grayish brown sandy loam about 7 inches thick. The subsurface layer is dark yellowish brown sandy loam about 3 inches thick. The subsoil is about 45 inches thick. In the upper part it is dark yellowish brown, friable sandy loam; in the middle part it is dark brown and dark yellowish brown, friable sandy loam; and in the lower part it is dark yellowish brown and yellowish brown,

tillage help to control soil blowing. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff and erosion. Returning crop residue to the soil and regularly adding other organic matter help maintain or increase the content of organic matter. Farming on the contour minimizes the equipment limitations associated with slope.

The use of these soils as pasture or hayland is effective in controlling erosion. If these soils are used as pasture and hayland, overcoming equipment limitations associated with slope is a major concern of management. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion. Seeding and fertilizing on the contour minimize the equipment limitations.

If these soils are used as woodland, plant competition is a major concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

These soils are generally not suitable for use as sites for sewage lagoons and for use as septic tank absorption fields because of slope.

The use of these soils for building site development is limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Buildings can be designed to offset the slope. Roads and streets should be built on the contour. Cleared areas around construction sites should be protected from soil erosion by the use of mulch, asphalt spray, or netting or by grass seeding. On the Riddles soils, the shrinking and swelling of the subsoil is an additional limitation to building site development. This limitation can be overcome by replacing the subsoil material with more suitable soil material.

This complex is in capability subclass IVe and Michigan soil management groups 3a and 2.5a.

49E—Hillsdale-Riddles sandy loams, 18 to 30 percent slopes. These are steep and very steep, well drained soils on hills and ridges and on side slopes along streams. The areas are irregular in shape and range from 3 to 100 acres. The Hillsdale soil makes up 45 to 65 percent of this complex, and the Riddles soil makes up 20 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Hillsdale soil has a surface layer that is dark grayish brown sandy loam about 5 inches thick. The subsurface layer is dark yellowish brown sandy loam about 3 inches thick. The subsoil is about 43 inches thick. In the upper part it is dark yellowish brown, friable sandy loam; in the middle part it is dark brown and dark yellowish brown, friable sandy loam; and in the lower part it is dark yellowish brown and yellowish brown, friable sandy loam. The substratum to a depth of about 66 inches is yellowish brown, calcareous sandy loam.

Typically, the Riddles soil has a surface layer that is dark brown sandy loam about 6 inches thick. The

subsurface layer is yellowish brown sandy loam about 3 inches thick. The subsoil is about 37 inches thick. In the upper part it is yellowish brown, firm sandy clay loam and clay loam; in the middle part it is dark yellowish brown, friable sandy clay loam; and in the lower part it is yellowish brown, friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous sandy loam. In some areas the substratum is at a depth of less than 40 inches, and in some areas it is gravelly sand.

Included in mapping are small areas of well drained Spinks and Arkport soils that have more sand in the subsoil than the Hillsdale and Riddles soils. These Spinks and Arkport soils are scattered throughout the complex, and they make up about 5 to 20 percent of the complex. Also included are small areas of somewhat poorly drained Teasdale soils in depressions and drainageways. These soils make up about 5 percent of the complex. Also included are small areas of well drained Leoni soils that have more pebbles and cobbles in the subsoil than the Hillsdale and Riddles soils. These Leoni soils are scattered throughout the complex, and they make up about 5 percent of the complex.

Permeability is moderate. The available water capacity is moderate. Surface runoff is rapid.

In most areas these soils are used as pasture and woodland. They have good potential use as woodland and as habitat for woodland wildlife. They have fair potential for use as pasture and hayland and as habitat for openland wildlife. These soils have poor potential for use as cropland, for recreation uses, for use as sites for sanitary facilities, and for building site development. They have very poor potential for use as habitat for wetland wildlife.

Crop production is generally not economically practical on these soils because of the steepness of slope.

If these soils are used as pasture and hayland, equipment limitations associated with slope and a hazard of water erosion are major concerns of management. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff.

If these soils are used as woodland, equipment limitations, erosion, and plant competition are concerns of management. The use of heavy equipment for planting, tending, and harvesting trees is restricted because of the steepness of slope. Limiting the construction of logging roads and skid trails to the gentler slopes helps prevent erosion and overcome the equipment limitations. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

These soils are generally not suited to use as septic tank absorption fields, to use as sites for sewage lagoons, and to building site development because of the steepness of slope.

This complex is in capability subclass VIe and Michigan soil management groups 3a and 2.5a.

51—Udorthents and Udipsamments, nearly level.

This map unit consists of soils from which the original surface layer and subsoil and some of the substratum have been removed or of soils that are covered by fill. The soil material is somewhat excessively drained to somewhat poorly drained. The areas range from 3 to 60 or more acres.

These soils vary greatly in some important soil properties, especially texture and drainage.

Included in mapping are small areas of poorly drained soils that make up 5 to 10 percent of the unit.

Most areas of these soils are idle or are used as building sites. Many areas are filled with organic soil.

Some areas are sanitary landfills. Onsite investigation is necessary for specific uses.

This map unit is not assigned to an interpretive grouping.

52—Pits, gravel. This is a miscellaneous area that consists of open excavations from which sand and gravel have been removed for use as fill or aggregate (fig. 11). The exposed material supports few plants. Where the excavation extends below the water table, the bottom may be flooded seasonally or year round. Areas range from 3 to 80 acres.



Figure 11.—This gravel pit is in an area of Boyer-Leoni complex, 18 to 40 percent slopes.



Figure 12.—This sandstone quarry is in an area of Eleva sandy loam, 1 to 6 percent slopes, near Napoleon.

Most areas are used as wildlife habitat or are still being mined. A few areas are used for recreation. The potential is poor for use as cropland, pasture, and woodland. The areas are too variable to be rated for other uses. Onsite investigation is necessary for specific uses.

This miscellaneous area is not assigned to an interpretive grouping.

53—Pits, quarries. This is a miscellaneous area that consists of open excavations from which limestone or

sandstone has been removed (fig. 12). The exposed rock supports few or no plants. Where the excavation is below the water table, the bottom may be flooded seasonally year around. Areas range from 40 to 60 or more acres.

Most areas are still being mined. The potential is poor for use as cropland, pasture, woodland. The areas are too variable to be rated for other uses. Onsite investigation is necessary for specific uses.

This miscellaneous area is not assigned to an interpretive grouping.

55B—Eleva sandy loam, 1 to 6 percent slopes. This is an undulating, well drained and somewhat excessively drained soil on broad, flat uplands and on low ridges and knolls. The areas are irregular in shape and range from 3 to 120 or more acres.

Typically, the surface layer is dark brown sandy loam about 10 inches thick. The subsurface layer is yellowish brown sandy loam about 6 inches thick. The subsoil is dark yellowish brown and brown friable sandy loam.

55C—Eleva sandy loam, 6 to 12 percent slopes.

This is a rolling, well drained and somewhat excessively drained soil on broad uplands consisting of ridges and knolls. The areas are irregular in shape and range from 3 to 80 or more acres.

Typically, the surface layer is dark brown sandy loam about 9 inches thick. The subsurface layer is yellowish brown sandy loam about 5 inches thick. The subsoil is dark yellowish brown and brown friable sandy loam.

the slope limitation can be overcome by shaping the site and by using retaining walls. This soil can be used as a site for dwellings with basements if fill material is used to raise the site. The fill material should be well compacted. Roads and streets should be built on the contour.

This map unit is in capability subclass IIIe and Michigan soil management group 3/Ra.

56D—Riddles-Leoni complex, 10 to 20 percent slopes. These are rolling to steep, well drained soils on hills, ridges, knolls, and slopes adjacent to streams. The areas are irregular in shape and range from 3 to 60 or more acres. The Riddles soils make up 40 to 60 percent of this complex, and the Leoni soils make up 20 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Riddles soils have a surface layer that is dark brown sandy loam about 7 inches thick. The subsurface layer is yellowish brown sandy loam about 3 inches thick. The subsoil is about 37 inches thick. In the upper part it is yellowish brown, firm sandy clay loam and clay loam; in the middle part it is dark yellowish brown, friable sandy clay loam; and in the lower part it is dark yellowish brown, friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous sandy loam. In some places, the subsoil contains less clay. In some areas the substratum is at a depth of less than 40 inches, and in some areas it is gravelly sand.

Typically, the Leoni soils have a surface layer that is very dark grayish brown gravelly sandy loam about 6

inches thick, and overcoming equipment limitations associated with slope are the major concerns of management. Equipment limitations associated with the high content of gravel and cobbles is an additional concern on the Leoni soils. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control runoff and erosion. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter in the soil and to increase the available water capacity of the soil. Conservation tillage helps to conserve soil moisture. Working these soils when they are too wet results in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth. Farming on the contour helps to minimize equipment limitations associated with slope. In most areas there are enough cobbles in the surface layer to make seedbed preparation and harvesting difficult.

The use of these soils as pasture or hayland is effective in controlling erosion. If these soils are used as pasture and hayland, the hazard of droughtiness and equipment limitations associated with slope are major concerns of management. In summer the Leoni soils often do not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing helps to maintain production during the dry periods. Maintaining an adequate vegetative cover by preventing overgrazing helps to control erosion. Seeding and fertilizing on the contour minimize the equipment limitations associated with slope.

If these soils are used as woodland, plant competition

ridges and plateaus. The areas of this complex are small. They have good potential for lawns, vegetable, and

complex are irregular in shape and range from 10 to 500 or more acres. This complex is 40 to 75 percent Urban land, 0 to 30 percent Barry soils, and 0 to 30 percent Brady soils. The areas of Urban land and the Barry and Brady soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification of the soils is not feasible.

Typically, the Barry soils have a surface layer that is black loam about 10 inches thick. The subsoil is mottled

flower gardens, and trees and shrubs. They have poor potential for recreation uses, sanitary facilities, and building site development.

The use of Barry and Brady soils as septic tank absorption fields and for building site development is limited by the high water table. These soils are subject to frost action. Sanitary facilities will not function properly because of the high water table. Only public sewage facilities should be used.

This complex is not assigned to an interpretive grouping.

58B Urban land Oshawa complex 0 to 5 percent

good potential for lawns, vegetable and flower gardens, trees and shrubs, recreation uses, and most kinds of building site development. They have poor potential for sanitary facilities.

The use of the Oshtemo soils as septic tank absorption fields is limited by the poor filtering capacity. Only public sewage facilities should be used.

This complex is not assigned to an interpretive grouping.

58C—Urban land-Oshtemo complex, 6 to 15 percent slopes. This complex consists of Urban land and rolling and hilly, well drained Oshtemo soils on broad uplands consisting of knolls and ridges. The areas are irregular in shape and range from 5 to 200 or more acres. The Urban land makes up 50 to 80 percent of the complex, and the Oshtemo soils make up 10 to 40 percent. The areas of Urban land and Oshtemo soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification of the soils is not feasible.

Typically, the Oshtemo soils have a surface layer that is dark brown sandy loam about 8 inches thick. The subsurface layer is yellowish brown sandy loam about 7 inches thick. The subsoil is about 35 inches thick. In the upper part it is strong brown, friable gravelly sandy loam; in the middle part it is yellowish red, firm gravelly sandy clay loam; and in the lower part it is strong brown, loose sand and bands, 1/8 to 1 inch thick, of very friable loamy sand. The substratum to a depth of about 60 inches is yellowish brown, calcareous gravelly sand. In some places the sandy material above the subsoil is 20 or more inches thick. In some places, the subsoil contains more clay. In some areas the substratum is at a depth of less than 40 inches. Also in some areas the subsoil is more than 30 percent pebbles.

Included in mapping are small areas of somewhat poorly drained Brady soils and very poorly drained Gilford soils in depressions and drainageways. These soils make up 5 to 15 percent of the complex. Also included are small areas of very poorly drained Palms soils in depressions. These soils make up about 5 percent of the complex. In some areas the soil material has been radically altered. Small areas have been filled, leveled, built up, cut, or smoothed during construction. In some areas sandstone bedrock is within 5 feet of the surface.

Permeability in the Oshtemo soils is moderately rapid in the upper part of the profile and very rapid in the lower part. The available water capacity is moderate. Surface runoff is medium.

The Oshtemo soils make up the lawns, gardens, parks, and other open parts of the complex. They have good potential for trees and shrubs. They have fair potential for lawns, vegetable and flower gardens, most recreation uses, and most kinds of building site

development. They have poor potential for sanitary facilities.

The use of the Oshtemo soils as septic tank absorption fields is limited by poor filtering capacity. Only public sewage facilities should be used.

This complex is not assigned to an interpretive grouping.

59B—Urban land-Riddles complex, 0 to 6 percent slopes. This complex consists of Urban land and nearly level and undulating, well drained Riddles soils on broad, flat uplands and on low knolls and ridges. The areas are irregular in shape and range from 10 to 200 or more acres. The Urban land makes up 50 to 80 percent of the complex, and the Riddles soils make up 10 to 40 percent. The areas of Urban land and Riddles soil are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification of the soils is not feasible.

Typically, the Riddles soils have a surface layer that is dark brown sandy loam about 9 inches thick. The subsurface layer is yellowish brown sandy loam about 4 inches thick. The subsoil is about 41 inches thick. In the upper part it is yellowish brown, firm sandy clay loam and clay loam; in the middle part it is dark yellowish brown, firm sandy clay loam; and in the lower part it is yellowish brown, friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous sandy loam. In some places, the subsoil contains less clay. In some areas the substratum is at a depth of less than 40 inches, and in some areas it is gravelly sand. In some places, the content of pebbles and cobbles is more than 10 percent.

Included in mapping are small areas of somewhat poorly drained Teasdale and Brady soils in depressions and drainageways. These soils make up 5 to 10 percent of the complex. Also included are small areas of very poorly drained Palms soils in depressions. These soils make up about 5 percent of the complex. In some areas the soil material has been radically altered. Some of the low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed. In some areas sandstone bedrock is within 5 feet of the surface.

Permeability is moderate. The available water capacity is moderate. Surface runoff is slow.

The Riddles soils make up the lawns, gardens, parks, and other open parts of the complex. They have good potential for lawns, vegetable and flower gardens, trees and shrubs, recreation uses, and most kinds of building site development and for use as septic tank absorption fields.

This complex is not assigned to an interpretive grouping.

59C—Urban land-Riddles complex, 6 to 15 percent slopes. This complex consists of Urban land and rolling

and hilly, well drained Riddles soils on broad uplands consisting of ridges and knolls. The areas are irregular in shape and range from 10 to 60 or more acres. The Urban land makes up 50 to 80 percent of the complex, and the Riddles soils make up 10 to 40 percent. The areas of Urban land and Riddles soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification of the soils is not feasible.

Typically, the Riddles soils have a surface layer that is dark brown sandy loam about 8 inches thick. The subsurface layer is yellowish brown sandy loam about 4 inches thick. The subsoil is about 39 inches thick. In the upper part it is yellowish brown, firm sandy clay loam and clay loam; in the middle part it is dark yellowish brown, firm sandy clay loam; and in the lower part it is yellowish brown, friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous sandy loam. In some places the subsoil contains less clay. In some areas the substratum is at a depth of less than 40 inches, and in some areas it is gravelly sand. In some places, the contact between the subsoil and the substratum is

The Udorthents vary greatly in some important soil properties, especially texture and drainage. The original soil material has been removed or has been covered with fill.

Included in mapping are small areas of poorly drained soils that make up 5 to 10 percent of the complex. In some areas, sandstone bedrock is within 5 feet of the surface.

The Udorthents are idle or are used as building sites. Onsite investigation is necessary for specific uses.

This complex is not assigned to an interpretive grouping.

61B—Saylesville silt loam, 2 to 8 percent slopes.

This is an undulating and rolling, well drained soil on broad uplands consisting of ridges and knolls. The areas are irregular in shape and range from 3 to 60 or more acres.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown loam about 2 inches thick. The subsoil is silty clay loam about 12 inches thick. In the upper part it is yellowish brown, and in the lower part it is dark brown. The substratum to a depth of about 60 inches is brown

hayland, preventing surface compaction is a major concern of management. Overgrazing or grazing when this soil is too wet can cause surface compaction and destroy forage plants. Proper stocking rates, rotation

help to control wetness. Shallow surface ditches are effective in removing surface water from low areas after heavy rains. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Cover crops, grassed waterways, and conservation

do not have an organic layer. These soils are on slightly higher positions along the edges of the map unit, and they make up about 5 to 10 percent of the unit.

Permeability is moderate. The available water capacity is high. Surface runoff is very slow or ponded. This soil has a high water table near or above the surface from November to May. This soil is often low in some micronutrients.

In most areas this soil has a cover of natural vegetation, including trees. In some areas it is drained for use as cropland. In a few areas it is used as pasture. This soil has good potential for use as cropland, especially for truck and specialty crops. It also has good potential for use as pasture and hayland. It has poor potential for woodland use, for recreation uses, for use as a site for sanitary facilities, and for building site development.

If this soil is cultivated, removing excess water, controlling ponding, providing adequate drainage outlets, controlling soil blowing and subsidence after drainage, and overcoming equipment limitations associated with soil stability are major concerns of management. Frost action is a hazard in some areas. Artificial drainage is needed for crop production. Lift pumps may be needed at the drainage outlet in some areas. If this soil is drained, soil blowing is a hazard. Tree windbreaks, buffer strips, and cover crops help to control the soil blowing. Controlled drainage improves soil stability and reduces subsidence. This soil may be deficient in nutrients, especially micronutrients, needed by some crops;

64B—Marlette-Owosso complex, 2 to 6 percent slopes. This complex consists of undulating, well drained Marlette soils and Owosso soils on broad, nearly flat uplands and on low knolls and ridges. The areas are irregular in shape and range from 3 to 130 or more acres. The Marlette soils make up 40 to 60 percent of the complex, and the Owosso soils make up 20 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Marlette soils have a surface layer that is dark brown loam about 8 inches thick. The subsoil is about 24 inches thick. In the upper part it is dark yellowish brown, firm clay loam that has coatings of brown loam on the faces of peds, and in the lower part it is dark yellowish brown, firm clay loam. The substratum to a depth of about 60 inches is brown, calcareous loam. In some areas the subsoil does not have the loam coatings on the faces of peds in the upper part. In some areas the substratum is at a depth of less than 25 inches.

Typically, the Owosso soils have a surface layer that is dark brown sandy loam about 8 inches thick. The subsoil is dark brown and is about 35 inches thick. In the upper part it is very friable and friable sandy loam; in the middle part it is firm sandy clay loam; and in the lower part it is dark brown, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous loam. In some places, the subsoil contains less clay in the lower part.

Included in mapping are small areas of somewhat

crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff and erosion. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter. Working these soils when they are too wet results in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth. Controlling soil blowing is an additional concern of management on the Owosso soils. Tree windbreaks, buffer strips, cover crops, and conservation tillage help to control the soil blowing.

The use of these soils as pasture or hayland is effective in controlling erosion. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion.

If these soils are used as woodland, plant competition is a concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

The use of these soils as septic tank absorption fields is limited by the moderately slow permeability.

Conventional septic tank absorption fields generally are not practical in these soils. The use of these soils as sites for sewage lagoons is limited by slope. Landshaping can help overcome this limitation.

These soils have few limitations for building site development. On the Owosso soils, shrinking and swelling is a limitation to this use. The shrinking and swelling can be controlled by replacing the pertinent layers with suitable soil material.

This complex is in capability subclass IIe and Michigan soil management groups 2.5a and 3/2a.

64C—Marlette-Owosso complex, 6 to 12 percent slopes. This complex consists of rolling, well drained Marlette soils and Owosso soils on broad uplands consisting of knolls and ridges and along streams. The areas are irregular in shape and range from 3 to 140 or more acres. The Marlette soils make up 40 to 60 percent of the complex, and the Owosso soils make up 20 to 40 percent. The areas of these soils are so intricately mixed or so small that it is not practical to separate them in mapping at the scale used.

Typically, the Marlette soils have a surface layer that is dark brown loam about 8 inches thick. The subsoil is about 24 inches thick. In the upper part it is dark yellowish brown, firm clay loam that has coatings of brown loam on the faces of peds; in the lower part it is dark yellowish brown, firm clay loam. The substratum to a depth of about 60 inches is brown, calcareous loam. In some areas the subsoil does not have the loam coatings in the upper part. In some areas the substratum is at a depth of less than 25 inches.

Typically, the Owosso soils have a surface layer that is dark brown sandy loam about 8 inches thick. The subsoil is dark brown and is about 35 inches thick. In the upper part it is very friable and friable sandy loam; in the

middle part it is firm sandy clay loam; and in the lower part it is firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous loam. In some places the subsoil contains less clay in the lower part.

Included in mapping are small areas of somewhat poorly drained Capac soils in depressions and drainageways and on foot slopes. These soils make up about 10 percent of the complex. Also included are small areas of well drained Okee soils that have more sand in the surface layer and the subsoil than the Marlette and Owosso soils. These Okee soils are scattered throughout the complex, and they make up 10 to 15 percent of the complex.

Permeability in the Marlette soils is moderate or moderately slow. Permeability in the Owosso soils is moderately rapid in the surface layer and the upper part of the subsoil and moderately slow in the lower part of the subsoil and the substratum. The available water capacity is high. Surface runoff is medium.

In most areas these soils are used as cropland. In a few areas they are used as pasture or woodland. These soils have good potential for use as pasture, hayland, and woodland. They have fair potential for use as cropland, for most recreation uses, and for building site development. These soils have poor potential for use as sites for sewage lagoons and for use as septic tank absorption fields.

If these soils are cultivated, controlling water erosion and maintaining the content of organic matter and good soil tilth are major concerns of management. Controlling soil blowing is an additional concern of management on the Owosso soils. Cover crops, grassed waterways, and conservation tillage used in a crop rotation help to control surface runoff, water erosion, and soil blowing. Windbreaks and buffer strips also help to control soil blowing. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter. Working these soils when they are too wet results in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

The use of these soils as pasture or hayland is effective in controlling erosion. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion.

If these soils are used as woodland, plant competition is a concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

The use of these soils as septic tank absorption fields is limited by the moderately slow permeability and the slope. Conventional septic tank absorption fields generally are not practical in these soils. Installing the absorption field across the slope helps to overcome the slope limitation. These soils are generally not suited to use as sites for sewage lagoons because of the slope.

The use of these soils for building site development is limited by slope. For buildings, this limitation can be overcome by shaping the site and by using retaining walls. Buildings can be designed to offset the slope. Roads and streets should be built on the contour. Cleared areas around construction sites should be protected from erosion by the use of mulch, asphalt spray, or netting or by grass seeding. On the Owosso soils, shrinking and swelling is an additional limitation to building site development. This limitation can be overcome by replacing the pertinent layers with more suitable soil material.

This complex is in capability subclass IIIe and Michigan soil management groups 2.5a and 3/2a.

65A—Capac loam, 0 to 3 percent slopes. This is a nearly level and gently sloping, somewhat poorly drained soil in broad, flat areas, on low ridges and knolls, and on foot slopes. The areas of this map unit are irregular or elongated in shape and range from 3 to 240 or more acres.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsoil is mottled and is about 26 inches thick. In the upper part it is dark yellowish brown and yellowish brown, friable loam; and in the lower part it is dark yellowish brown and yellowish brown, firm clay loam. The substratum to a depth of about 60 inches is light olive brown, mottled, calcareous loam.

Included in mapping are small areas of well drained Marlette soils on high ridgetops and on the top of knolls. These soils make up about 5 percent of the map unit. Also included are small areas of somewhat poorly drained Teasdale soils that have less clay in the subsoil than the Capac soil. These soils are scattered throughout the map unit, and they make up about 5 percent of the unit. Also included are small areas of poorly drained Barry soils in depressions and drainageways. These soils make up about 5 percent of the map unit.

Permeability is moderate or moderately slow. The available water capacity is high. Surface runoff is slow. This soil has a high water table 1 to 2 feet below the surface from November to May.

In most areas this soil is used as cropland. In a few areas it is used as pasture or woodland. This soil has

it is too wet results in compaction and the formation of clods. Conservation tillage, cover crops, crop residue returned to the soil, and regular additions of other organic matter help to maintain good soil tilth.

If this soil is used as pasture and hayland, excess water during wet periods and surface compaction are major concerns of management. Overgrazing or grazing on this soil when it is too wet can cause surface compaction and destroy forage plants. Proper stocking rates, rotation grazing or strip grazing, and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If this soil is used as woodland, plant competition is a major concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

The use of this soil as septic tank absorption fields is severely limited by the seasonal high water table and by the moderate or moderately slow permeability.

The use of this soil as a site for buildings is limited by the seasonal high water table. This soil can be used as a site for buildings without basements if suitable fill material is used to raise the site and if a subsurface drainage system is installed. The use of this soil as a site for local roads and streets is limited by the hazard of frost action and the low strength of the soil. The included Marlette soils are better suited to building site development because they are better drained.

This map unit is in capability subclass IIw and Michigan soil management group 2.5b.

66E—Eleva Variant channery fine sandy loam, 15 to 30 percent slopes. This is a hilly to very steep, well drained soil on the side slopes of ridges and hills. The areas are irregular or elongated in shape and range from 3 to 80 or more acres.

Typically, the surface layer is very dark grayish brown channery fine sandy loam about 4 inches thick. The subsurface layer is yellowish brown channery fine sandy loam about 2 inches thick. The subsoil is yellowish brown, friable very channery sandy loam about 18 inches thick. The substratum to a depth of about 42 inches is yellowish brown weathered bedrock breaking to channery sandy loam. Unweathered sandstone bedrock is at a depth of about 42 inches. In some places, unweathered sandstone bedrock is at a depth greater

for woodland use. It has fair potential for use as pasture and hayland. It has poor potential for use as cropland, for recreation uses, for use as a site for facilities, and for building site development.

Crop production is usually not economically practical on this soil because of the steepness of slope.

If this soil is used as pasture and hayland, equipment limitations associated with slope and the hazards of water erosion and droughtiness are major concerns of management. In summer this soil often does not have sufficient moisture for optimum plant growth. Rotation grazing or strip grazing helps to maintain production during the dry months. Maintaining an adequate vegetative cover by preventing overgrazing helps to control surface runoff and erosion.

If this soil is used as woodland, equipment limitations and plant competition are major concerns of management. The use of heavy equipment for planting, tending, and harvesting trees is restricted because of the steepness of slope. Constructing logging roads and skid trails on the gentler slopes helps to control erosion and overcome equipment limitations. Disking and the use of herbicides help to control the growth of undesirable vegetation.

This soil is generally not suited to use as septic tank

limestone is extracted. This soil has good potential for use as cropland, pasture, hayland, and woodland. It has fair potential for most recreation uses, for use as a site for sewage lagoons, and for most kinds of building site development. It has poor potential for use as septic tank absorption fields.

If this soil is cultivated, maintaining the content of organic matter and good soil tilth are major concerns of management. Returning crop residue to the soil and regularly adding other organic matter help to maintain or increase the content of organic matter. Working this soil when it is too wet results in compaction and the formation of clods. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

If this soil is used as pasture and hayland, preventing surface compaction is a major concern of management. Overgrazing or grazing when this soil is too wet can cause surface compaction and destroy forage plants. Proper stocking rates, rotation grazing or strip grazing, and restriction on grazing during wet periods help to keep the pasture plants and the soil in good condition.

If this soil is used as woodland, plant competition is a major concern of management. Intensive site preparation and herbicides help to control the growth of undesirable trees and shrubs.

inches thick. In the upper part it is firm gravelly sandy clay loam; and in the lower part it is firm and friable gravelly sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown, calcareous very gravelly loamy sand. In some areas the substratum is at a depth of less than 40 inches.

Included in mapping are small areas of somewhat poorly drained Brady soils in depressions and drainageways. These soils make up about 5 percent of

and sides of the lagoons with impervious material helps to control seepage. If the Oshtemo soils are used as septic tank absorption fields, ground water pollution is a hazard because the soil material cannot adequately filter the effluent. Filling or mounding the absorption field site with suitable material increases the filtering capacity of the Oshtemo soils. The Leoni soils are better suited to use as septic tank absorption fields than the Oshtemo

the complex. Also included are small areas of well drained Spinks soils that have more sand in the subsoil than the Oshtemo and Leoni soils. These Spinks soils are scattered throughout the complex, and they make up about 5 percent of the complex.

These soils have few limitations for building site development. The walls of shallow excavations tend to cave in and, therefore, need to be reinforced.

This complex is in capability subclass IIIs and Michigan soil management groups 3a and Ga.

low for the Leoni soils and moderate for the Oshtemo

during the dry periods. Overgrazing during the dry periods increases the hazard of soil blowing on the

[REDACTED]

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural

yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given

positions, where frost is frequent and air drainage is poor, however, are generally poorly suited to early vegetables, small fruits, and orchard crops.

The latest information and suggestions for growing crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Most of the arable soils in the county respond well to nitrate, phosphate, and potash fertilizers. The organic soils may be deficient in the nutrients, especially micronutrients such as zinc, boron, manganese, and copper, needed by some crops and should respond to micronutrient fertilizers. Many of the mineral soils may need periodic applications of ground limestone to raise their pH sufficiently for good growth of alfalfa and other crops that grow well only on slightly acid or neutral soils. On all soils the amount of lime and fertilizer used should be based on the results of soil tests, on the needs of the crop, and on the expected yield (5). The Cooperative Extension Service can help to determine the amount of fertilizer and lime to apply.

Organic matter is an important source of nitrogen for crops. It also promotes good soil tilth, reduces surface crusting, increases the available water capacity and water intake rate of the soil, and reduces erosion. Maintaining a high content of organic matter is a concern of management on most of the well drained to somewhat poorly drained soils that are used as cropland. Using a crop rotation that includes grasses and legumes, returning crop residue to the soil, and regularly adding other organic matter maintain or increase the organic matter content.

Maintaining good soil tilth is a concern of management on most of the somewhat poorly drained and poorly drained soils that are used as cropland. It is also a concern on the well drained Riddles, Saylesville, Mariette, Owosso, and Whalan soils. Working these soils when they are too wet results in compaction and the formation of clods. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields. The compaction of the soil and the reduction in the content of organic matter in the soil increase the severity of surface crusting. Surface crusting hinders seedling emergence and increases runoff and erosion. Conservation tillage, cover crops, and crop residue and other organic matter help to maintain good soil tilth.

Conserving soil moisture during dry periods is a concern of management on the Arkport, Boyer, Eleva, Leoni, Okee, Ormas, Oshtemo, and Spinks soils. Conservation tillage, which leaves much of the crop residue on the surface, helps to conserve soil moisture. Increasing a soil's organic matter content increases its available water capacity. Irrigation increases crop yields and has become an important practice in the county in the last few years. The droughty soils and many other soils in the county are suited to irrigation if proper

conservation and management practices are followed. The soil features that affect the design, layout, construction, management, and performance of irrigation systems are identified in table 14.

Soil erosion is a major hazard on most of the cropland in Jackson County. Soil erosion reduces the productivity of the soil by removing the surface layer, which contains most of the available plant nutrients and most of the organic matter. Soil erosion on farmland in many areas also results in the pollution of streams by sediment, nutrients, and pesticides. Controlling erosion is a concern of management on all of the soils that have slopes of 6 percent or more. It is also a concern on Mariette-Owosso complex, 2 to 6 percent slopes; Riddles sandy loam, 2 to 6 percent slopes; Hillsdale-Riddles sandy loams, 1 to 6 percent slopes; Del Rey silt loam, 0 to 3 percent slopes; and Saylesville silt loam, 2 to 8 percent slopes.

Erosion control practices provide a protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps a plant cover on the soil for extended periods reduces erosion and preserves the productive capacity of the soils. Legume and grass forage crops used in a cropping system reduce erosion on sloping land, provide nitrogen for other crops, and improve soil tilth. Conservation tillage used in a cropping system helps to control surface runoff and erosion. Cover crops, crop residue, and grassed waterways also help prevent erosion.

Soil blowing is a hazard on the sandy Arkport, Okee, Ormas, and Spinks soils and on the mucky Edwards, Henrietta, Houghton, Martisco, Napoleon, and Palms soils. Some of the loamy soils are also susceptible to soil blowing. Maintaining a plant cover, using surface mulch, planting buffer strips, and roughing the surface through tillage minimize soil blowing on these soils. Conservation tillage helps to control soil blowing by leaving crop residue on the surface. Vegetative barriers such as shrub and tree windbreaks also help to reduce soil blowing.

Some soils are naturally so wet that they are not suitable for use as cropland and pasture unless they are artificially drained. These are the poorly drained Barry, Cohoctah, Colwood, Lenawee, and Sebawa soils and the very poorly drained Edwards, Gilford, Henrietta, Houghton, Martisco, Napoleon, Palms, and Wauseon soils. The somewhat poorly drained Brady, Capac, Del Rey, Dixboro, Kibbie, Teasdale, and Ypsi soils also require artificial drainage for optimum crop yields.

The design of surface and subsurface drainage systems varies with the kind of soil. A combination of surface and subsurface drainage is needed in most areas of the somewhat poorly drained, poorly drained, and very poorly drained soils that are intensively row cropped. Finding adequate outlets for drainage systems is difficult in some areas.

Information on erosion control and drainage practices for each kind of soil can be obtained at the local office of the Soil Conservation Service.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (9). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6.

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification to which a soil has been assigned is given at the end of the description of each soil in the section "Detailed soil map units."

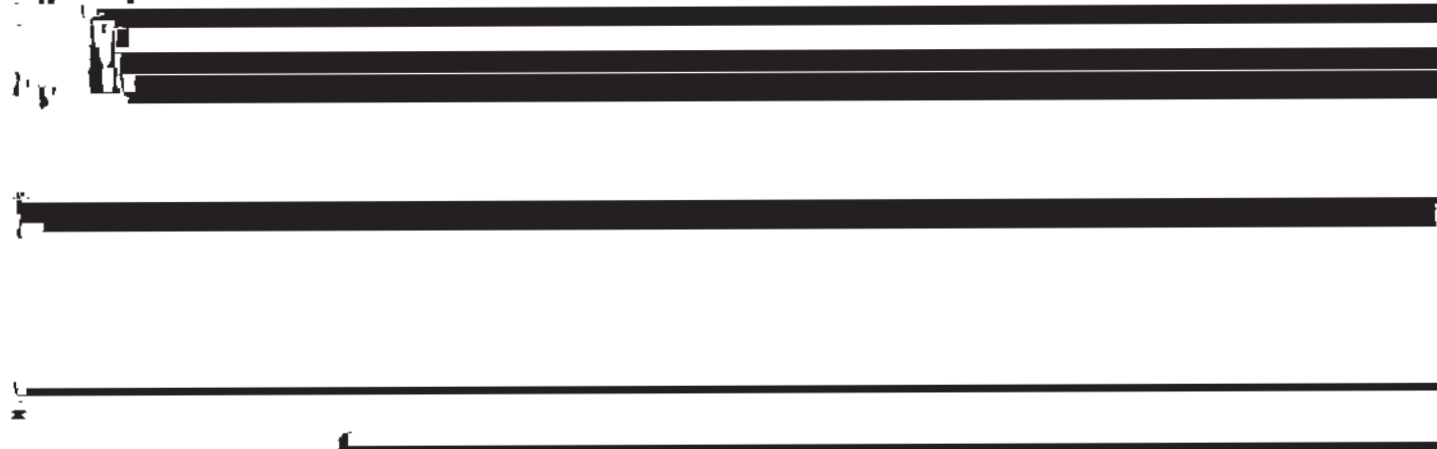
Also given at the end of each description is a Michigan soil management group. The soils are assigned to a group according to need for lime and fertilizer and for artificial drainage and other practices. For soils making up a soil complex, the soil management groups are listed in the same order as the series named in the complex.

For a detailed explanation of the Michigan soil management groups see Michigan State University Extension Bulletin E-1262 (6).

woodland management and productivity

David J. Poe, forester, Soil Conservation Service, assisted in writing this section.

Virgin forest areas covered almost all of the land in



Jackson County, but the trees have been cleared from most of the land suitable for cultivation. In much of the remaining woodland the soils are too wet or too steep for farming. These soils produce trees of high quality if the woodland is managed properly.

Woodland now makes up about 115,000 acres, or about 25 percent, of the county. It is the dominant land use in associations 9 and 10 described in the section "General soil map units." Woodlots are scattered throughout the other soil associations in the county. On the upland soils mixed hardwoods, mainly red oak, black oak, white oak, bur oak, shagbark hickory, sugar maple, black cherry, and white ash, are the most common trees. In some areas of the upland soils, black walnut and sassafras are abundant. On the mineral soils in low-lying areas and on bottom lands, red maple, basswood, silver maple, cottonwood, sycamore, swamp white oak, green ash, and black ash are the most common trees. On the very poorly drained organic soils, tamarack, yellow birch, cottonwood, silver maple, red maple, swamp white oak, and black ash are the most common trees.

Much of the existing commercial woodland would benefit from thinning and other silvicultural practices such as the control of plant competition, disease, and insects. The Soil Conservation Service and Michigan Department of Natural Resources, Division of Forestry, can help determine specific woodland management needs.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or

special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on the soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that a few trees may be blown down by normal winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common* trees on a soil is expressed as a site index. This index is

from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well

and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that

wildlife habitat

Charles M. Smith, wildlife biologist, Soil Conservation Service, assisted in writing this section.

Jackson County has a large and varied population of fish and wildlife. The wooded areas are habitat for white-tailed deer, tree squirrels, raccoon, hawks, owls, and many types of songbirds. The farmed areas are habitat for ring-necked pheasant, cottontail, woodchuck, fox, and songbirds. The streams and lakes support bluegill, perch, smallmouth bass, largemouth bass, northern pike, and carp. Some of the lakes and wetland areas are nesting and feeding areas for the sandhill crane and other waterfowl during the fall and spring migrations.

In many areas in the county the wildlife habitat can be improved by increasing the food, cover, water, and living space that the wildlife need. The soils that are best suited to wildlife habitat are scattered throughout the county, in all of the soil associations described in the section "General soil map units." The Waterloo Recreation Area, which is mainly in associations 9 and 10, and the Sharonville State Game area, which is mainly in association 7, provide important wildlife habitat.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are orchardgrass, timothy, brome grass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are ragweed, goldenrod,

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include ring-necked pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include owls, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and opossum.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about

kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, and the available water capacity in the upper 40 inches affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use

features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pan are also considered.

landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties,

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of

of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow

constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings shown indicate the ability of the soil to be used as

waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, and restricted

permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (2) and the system

adopted by the American Association of State Highway and Transportation Officials (7).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.75, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and plasticity index (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

physical and chemical properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (oven-dry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil

each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent,

PL1. Once a year, monitor if intensive measures to reduce, moderate, or well drained or well drained soils

seasonally high for less than 1 month is not indicated in table 17.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 17 shows the expected initial subsidence, which usually is a result of drainage, and annual subsidence, which usually is a result of oxidation.

Not shown in the table is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the

freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (10). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 18, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquolls (*Hapl*, meaning minimal horizonation, plus *aquolls*, the suborder of the Mollisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate

and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Haplaquolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (8). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (10). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Arkport series

The Arkport series consists of deep, well drained, moderately rapidly permeable soils on moraines, lake

on lower positions on the landscape than the Arkport soils. The Hillsdale and Riddles soils contain more clay in the upper part of the solum. The Hillsdale, Okee, Riddles, and Arkport soils are on similar positions on the landscape.

Typical pedon of Arkport loamy fine sand in an area of Arkport-Okee loamy fine sands, 2 to 6 percent slopes, 1,270 feet west and 2,400 feet north of the SE. corner of sec. 8, T. 4 S., R. 1 E., in Columbia Township:

Ap—0 to 8 inches; dark brown (10YR 4/3) loamy fine sand; weak fine granular structure; very friable; slightly acid; abrupt smooth boundary.

A2—8 to 21 inches; yellowish brown (10YR 5/4) loamy fine sand; single grain; loose; slightly acid; abrupt wavy boundary.

A&B—21 to 62 inches; yellowish brown (10YR 5/6) loamy fine sand (A2); single grain; loose; many bands, 1/8 inch to 6 inches wide, of strong brown (7.5YR 5/6) fine sandy loam (B2t); weak medium subangular blocky structure; friable; slightly acid; abrupt irregular boundary.

C—62 to 66 inches; stratified yellowish brown (10YR 5/4) fine sand and very fine sand; single grain; loose; very friable; violent effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 40 to 90 inches. The solum is 0 to 15 percent pebbles and is very strongly acid to neutral.

The Ap horizon has color value of 4 or 5 and chroma of 2 or 3. It is dominantly loamy fine sand, but the range includes fine sandy loam. The A2 horizon has color value of 5 or 6 and chroma of 4 or 6. It is sand, fine sand, loamy sand, or loamy fine sand. Some pedons do not have an A2 horizon.

The A part of the A&B horizon is similar in color and texture to the A2 horizon. The B part has color value of 5 or 6 and chroma of 4 or 6. It is fine sandy loam, sandy loam, or loamy fine sand.

The C horizon has color value of 5 or 6 and chroma of 3 or 4. It is mildly alkaline or moderately alkaline.

Barry series

The Barry series consists of deep, poorly drained, moderately permeable soils on till plains and moraines. These soils formed in loamy glacial till. The slope is 0 to 2 percent.

The Barry soils are commonly adjacent to Palms, Riddles, and Teasdale soils on the landscape. The Palms soils have an organic horizon 16 to 50 inches thick, are very poorly drained, and are on lower positions on the landscape than the Barry soils. The Riddles soils are well drained, and the Teasdale soils somewhat poorly drained. These soils are on higher positions on the landscape than the Barry soils.

Typical pedon of Barry loam, 530 feet north and 100 feet west of the SE. corner of sec. 18, T. 2 S., R. 1 W., in Blackman Township:

Ap—0 to 10 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; friable; 4 percent pebbles; neutral; abrupt smooth boundary.

B21tg—10 to 14 inches; dark olive gray (5Y 3/2) loam; few fine prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; thick dark gray (10YR 4/1) and grayish brown (10YR 5/2) clay films on faces of peds; 4 percent pebbles; mildly alkaline; gradual smooth boundary.

B22tg—14 to 19 inches; dark gray (5Y 4/1) sandy clay loam; few fine prominent yellowish brown (10YR 5/6) mottles; strong medium subangular blocky structure; firm; thick very dark gray (5YR 3/1) clay films on faces of peds; 4 percent pebbles; mildly alkaline; gradual wavy boundary.

B23tg—19 to 26 inches; olive (5Y 5/3) sandy clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; thick very dark gray (5Y 3/1) clay films on faces of peds; 4 percent pebbles; mildly alkaline; gradual wavy boundary.

B3g—26 to 30 inches; olive (5Y 5/3) sandy loam; many medium prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very friable; 4 percent pebbles; mildly alkaline; gradual smooth boundary.

C1g—30 to 44 inches; grayish brown (2.5Y 5/2) sandy loam; weak fine subangular blocky structure; very friable; 6 percent pebbles; strong effervescence; moderately alkaline; gradual wavy boundary.

C2g—44 to 60 inches; grayish brown (2.5Y 5/2) loamy sand; massive; very friable; 8 percent pebbles; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 24 to 48 inches. The mollic epipedon ranges in thickness from 10 to 15 inches and commonly includes part of the argillic horizon. Pebbles make up 1 to 5 percent of the solum and 3 to 15 percent of the C horizon. The solum ranges from slightly acid to mildly alkaline.

The Ap horizon has color value of 2 or 3 and chroma of 1 or 2. It ranges in thickness from 10 to 13 inches. It is dominantly loam, but the range includes sandy loam and silt loam.

The B2tg horizon has hue of 2.5Y, 5Y, or 10YR, value of 3 to 6, and chroma of 1 to 3. It is sandy loam, loam, sandy clay loam, or clay loam. Some pedons do not have a B3 horizon.

The C horizon has hue of 2.5Y, 5Y, or 10YR, value of 5 or 6, and chroma of 2 or 3. It is loamy sand, sandy loam, or fine sandy loam. It is mildly alkaline or moderately alkaline.

Boyer series

The Boyer series consists of deep, well drained soils that are moderately rapidly permeable in the solum and very rapidly permeable in the substratum. These soils are on outwash plains, valley trains, eskers, and moraines. They formed in sandy and loamy glaciofluvial deposits. The slope ranges from 1 to 40 percent.

The Boyer soils are similar to Eleva and Oshtemo soils and are commonly adjacent to Brady, Ormas, Oshtemo, and Spinks soils on the landscape. The Eleva soils are underlain by weathered sandstone at a depth of 20 to 40 inches. The Oshtemo soils have a thicker and more acid solum than the Boyer soils. The Brady soils are somewhat poorly drained and are on lower positions on the landscape than the Boyer soils. The Ormas soils have more than 20 inches of sandy material above the Bt horizon. The Spinks soils have less clay in the solum and have a B horizon that consists of lamellae. The Ormas, Oshtemo, Spinks, and Boyer soils are on similar positions on the landscape.

Typical pedon of Boyer sandy loam in an area of Boyer-Oshtemo sandy loams, 1 to 6 percent slopes, 2,165 feet north and 2,660 feet east of the SW. corner of sec. 7, T. 4 S., R. 2 E., in Columbia Township:

Ap—0 to 11 inches; dark brown (10YR 3/3) sandy loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; very friable; 5 percent pebbles; slightly acid; abrupt smooth boundary.

B21t—11 to 25 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; 5 percent pebbles; thin clay films; medium acid; clear wavy boundary.

chroma of 3 to 6. It is dominantly sandy loam or gravelly sandy loam, but in some pedons it has thin layers of fine sandy loam and sandy clay loam. Some pedons have a B3 horizon.

The IIC horizon has color value of 5 or 6 and chroma of 2 or 4. It is sand, gravelly sand, or very gravelly sand. It is mildly alkaline or moderately alkaline.

Brady series

The Brady series consists of deep, somewhat poorly drained soils that are moderately rapidly permeable in the upper part of the profile and very rapidly permeable in the lower part. These soils are on outwash plains, valley trains, and moraines. They formed in sandy and loamy glaciofluvial deposits. The slope ranges from 0 to 3 percent.

These soils have a lighter colored surface layer than is defined in the range for the Brady series, but this difference does not alter their use and behavior.

The Brady soils are similar to Dixboro and Teasdale soils and are commonly adjacent to Barry, Boyer, Colwood, Gilford, Oshtemo, and Spinks soils on the landscape. The Dixboro soils have a stratified sandy and loamy C horizon. The Teasdale soils have a loamy C horizon. The Boyer, Oshtemo, and Spinks soils are well drained and are on higher positions on the landscape than the Brady soils. The Colwood and Barry soils are poorly drained and are on lower positions on the landscape than the Brady soils. The Gilford soils are very poorly drained and are on lower positions on the landscape than the Brady soils.

Typical pedon of Brady sandy loam, 0 to 3 percent,

concretions; 2 percent pebbles; slightly acid; clear irregular boundary.

B3—30 to 54 inches; yellowish brown (10YR 5/4) loamy sand; many fine distinct strong brown (7.5YR 5/6) and common fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) mottles; weak fine subangular blocky structure; very friable; dark brown (7.5YR 4/4) stains; few fine dark brown (7.5YR 3/2) iron-manganese concretions; neutral; 2 percent pebbles; clear wavy boundary.

IIC—54 to 60 inches; yellowish brown (10YR 5/4) sand; few fine distinct yellowish brown (10YR 5/6) mottles; single grain; loose; 5 percent pebbles; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates typically are 45 to 55 inches, but the range is 40 to 70 inches. The solum is 0 to 20 percent pebbles and is strongly acid to neutral.

The Ap horizon has color value of 3 or 4 moist, and 6 or more dry, and chroma of 1 or 2. It is 8 to 12 inches thick. The A2 horizon has color value of 5 or 6 and chroma of 2 or 3. The dominant texture of the A horizon is sandy loam, but the range includes loamy sand.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 6. It is dominantly sandy loam, but in some pedons it has thin layers of sandy clay loam and clay loam. Some pedons do not have a B3 horizon.

The C horizon has chroma of 2 to 4. It is sand or gravelly sand. Reaction ranges from neutral to moderately alkaline.

medium subangular blocky structure; friable; 3 percent pebbles; neutral; clear smooth boundary.

B21t—14 to 21 inches; yellowish brown (10YR 5/4) loam; common medium faint pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; thin dark grayish brown (10YR 4/2) clay films on vertical faces of peds; 3 percent pebbles; neutral; clear smooth boundary.

B22t—21 to 26 inches; dark yellowish brown (10YR 4/4) clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; strong medium subangular blocky structure; firm; thick dark brown (7.5YR 3/2) clay films in root channels and many medium dark brown (7.5YR 4/4) clay films on vertical faces of peds; 3 percent pebbles; neutral; clear smooth boundary.

B3—26 to 34 inches; yellowish brown (10YR 5/4) clay loam; many coarse prominent grayish brown (2.5Y 5/2) mottles; weak fine subangular blocky structure in upper part and massive in lower part; firm; 3 percent pebbles; mildly alkaline; gradual smooth boundary.

C—34 to 60 inches; light olive brown (2.5Y 5/6) loam; many medium prominent light brownish gray (10YR 6/2) mottles; massive; firm; 5 percent pebbles; slight effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 26 to 40 inches. The content of pebbles is 1 to 10 percent throughout. The solum ranges from medium acid to mildly alkaline.

The Ap horizon has color value of 3 or 4 moist, and 6

with depth and have more clay in the pedon. The Houghton soils have organic material more than 51 inches thick. The Palms soils have organic material 16 to 51 inches thick. The Gilford, Colwood, Houghton, Palms, and Cohoctah soils are on similar positions on the landscape.

Typical pedon of Cohoctah fine sandy loam, 2,515 feet west and 90 feet north of the center of sec. 35, T. 1 S., R. 1 W., in Rives Township:

A11—0 to 7 inches; black (10YR 2/1) fine sandy loam, very dark grayish brown (10YR 3/2) dry; many fine prominent yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; very friable; mildly alkaline; abrupt smooth boundary.

A12—7 to 11 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark brown (10YR 3/3) dry; many fine prominent dark brown (7.5YR 4/4) mottles; moderate fine subangular blocky structure; very friable; mildly alkaline; abrupt smooth boundary.

C1g—11 to 28 inches; dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) very fine sandy loam; many fine distinct dark brown (7.5YR 3/2) and many fine prominent dark brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; friable; mildly alkaline; clear smooth boundary.

C2g—28 to 40 inches; very dark gray (10YR 3/1) fine sandy loam; few fine distinct dark brown (7.5YR 3/2), few fine prominent dark brown (7.5YR 4/4), and few fine distinct grayish brown (10YR 5/2) mottles.

plains. These soils formed in stratified sandy, loamy, and silty glaciofluvial deposits. The slope is 0 to 2 percent.

The Colwood soils are similar to Gilford and Sebewa soils and are commonly adjacent to Dixboro, Gilford, and Palms soils on the landscape. The Gilford soils contain less clay in the lower part of the solum and less clay and silt in the substratum than the Colwood soils and are on positions on the landscape similar to those of the Colwood soils. The Sebewa soils have a sandy or sandy-skeletal substratum. The Dixboro soils are somewhat poorly drained and on higher positions on the landscape than the Colwood soils. The Palms soils have organic material 16 to 51 inches thick and are on slightly lower positions on the landscape than the Colwood soils.

Typical pedon of Colwood silt loam in an area of Gilford-Colwood complex, 2,400 feet west and 135 feet south of the center of sec. 7, T. 4 S., R. 1 E., in Columbia Township:

Ap—0 to 8 inches; very dark gray (10YR 3/1) silt loam; moderate medium subangular blocky structure; friable; neutral; abrupt smooth boundary.

A12—8 to 12 inches; very dark gray (10YR 3/1) very fine sandy loam; common fine distinct yellowish brown (10YR 5/4) and common fine prominent brownish yellow (10YR 6/6) mottles; moderate fine subangular blocky structure; friable; mildly alkaline; clear wavy boundary.

B1g—12 to 16 inches; dark grayish brown (10YR 4/2) very fine sandy loam; many medium faint brown (10YR 5/2) and many medium distinct yellowish

epipedon is 10 to 15 inches thick. The solum ranges from slightly acid to mildly alkaline.

The A horizon has color value of 2 or 3 and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam, very fine sandy loam, and sandy loam.

The B horizon has hue of 10YR, 7.5YR, 5Y, or 2.5Y and chroma of 1 to 8. It has many low-chroma mottles. It is clay loam, sandy clay loam, silty clay loam, silt loam, loam, very fine sandy loam, or fine sandy loam.

acid to neutral in the upper part and from slightly acid to moderately alkaline in the lower part.

The Ap horizon has color value of 3 or 4 moist, and 6 or more dry, and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam. Some pedons have an A2 horizon. It has color value of 4 to 6 and chroma of 1 or 2.

The B2t horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 4 to 6. It is silty clay or silty clay

The C horizon has hue of 10YR, 5Y, or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is stratified loamy very fine sand, fine sand, very fine sand, silt loam, silty clay loam, very fine sandy loam, or loamy sand. It is mildly alkaline or moderately alkaline.

Del Rey series

The Del Rey series consists of deep, somewhat poorly drained, slowly permeable soils on lake plains and terraces and in depressional areas on moraines. These soils formed in silty and clayey glaciolacustrine sediments. The slope ranges from 0 to 3 percent.

The Del Rey soils are similar to Saylesville soils and are commonly adjacent to Arkport, Lenawee, Okee, and

loam.

The C horizon is dominantly silty clay loam. In some pedons it is stratified, consisting of thin bands of sandy material and layers of silt loam, silty clay loam, or silty clay. It is mildly alkaline or moderately alkaline.

Dixboro series

The Dixboro series consists of deep, somewhat poorly drained, moderately permeable soils on lake plains and outwash plains. These soils formed in stratified sandy and loamy glaciofluvial deposits. The slope ranges from 0 to 3 percent.

These soils have a lighter colored surface layer and a thicker solum than defined for the Dixboro series, but

B221, 25 to 28 inches, strong brown (7.5YR 5/6) silt

mineral deposits. The Houghton, Martisco, and Palms

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outwash plains, and moraines. These soils formed in residuum of sandstone or in loamy glacial drift over sandstone bedrock. The slope ranges from 1 to 12 percent.

The Eleva soils are similar to Eleva Variant and Hillsdale soils and are commonly adjacent to Eleva Variant, Hillsdale, and Riddles soils on the landscape. The Eleva Variant soils have more sandstone fragments in the pedon than the Eleva soils. The Hillsdale and Riddles soils are not underlain by sandstone between depths of 20 and 40 inches. The Eleva, Eleva Variant, Hillsdale, and Riddles soils are on similar positions on the landscape.

Typical pedon of Eleva sandy loam, 1 to 6 percent slopes, 390 feet east and 2,240 feet south of the NW. corner of sec. 23, T. 3 S., R. 2 W., in Spring Arbor Township:

Ap—0 to 10 inches; dark brown (10YR 4/3) sandy loam; weak very fine granular structure; friable; strongly acid; abrupt smooth boundary.

A2—10 to 16 inches; yellowish brown (10YR 5/4) sandy

outwash plains, and moraines. These soils formed in residuum of sandstone bedrock. The slope ranges from 15 to 30 percent.

The Eleva Variant soils are similar to Eleva soils and are commonly adjacent to Eleva, Hillsdale, and Riddles soils on the landscape. The Eleva soils have fewer sandstone fragments in the solum. The Hillsdale and Riddles soils do not have sandstone between depths of 20 and 40 inches. The Eleva Variant, Eleva, Hillsdale, and Riddles soils are on similar positions on the landscape.

Typical pedon of Eleva Variant channery fine sandy loam, 15 to 30 percent slopes, 2,600 feet west and 2,000 feet south of the NE. corner of sec. 31, T. 4 S., R. 2 W., in Hanover Township:

A1—0 to 4 inches; very dark brown (10YR 2/2) channery fine sandy loam; moderately fine granular structure; very friable; 40 percent sandstone fragments; very strongly acid; clear smooth boundary.

A2—4 to 6 inches; yellowish brown (10YR 5/4) channery fine sandy loam; weak fine platy structure; very

General - laggy and sandy glaciofluvial deposits

The B2n horizon has hue of 2.5Y or 10YR, value of 4

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[REDACTED]

The solum is 20 to 50 inches thick. The histic epipedon is 8 to 15 inches thick. In the mineral horizons the content of pebbles ranges from 0 to 15 percent. The solum ranges from medium acid to mildly alkaline.

The Oap horizon has hue of 10YR, 7.5YR, or 5YR, value of 2 or 3, and chroma of 0 to 3.

The B2g horizon has hue of 10YR, 5Y, or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is dominantly loamy fine sand, silt loam, and fine sandy loam, but in some pedons it has strata of sandy clay loam, silt loam, sandy loam, loamy sand, fine sand, or sand.

The Cg horizon has hue of 10YR, 5Y, or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is loamy fine sand or stratified silt loam, loam, sandy loam, fine sandy loam, loamy fine sand, or sand.

Hillsdale series

The Hillsdale series consists of deep, well drained, moderately permeable soils on till plains and moraines. These soils formed in loamy glacial till. The slope ranges from 1 to 30 percent.

The Hillsdale soils are similar to Elewa and Oshtemo soils and are commonly adjacent to Arkport, Okee, and Riddles soils on the landscape. The Elewa soils have sandstone between 20 and 40 inches. The Oshtemo soils have a sand and gravel substratum. The Arkport soils have more sand in the solum than the Hillsdale soils and have a B horizon that consists of lamellae. The Okee soils have more than 20 inches of sandy material above the B2 horizon. The Riddles soils have more clay in the B2t horizon than the Hillsdale soils. The Hillsdale, Arkport, Okee, and Riddles soils are on similar positions on the landscape.

Typical pedon of Hillsdale sandy loam in an area of Hillsdale-Riddles sandy loams, 1 to 6 percent slopes, 1,170 feet west and 1,000 feet north of the SE. corner of sec. 10, T. 4 S., R. 1 W., in Liberty Township:

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) sandy loam; weak fine subangular blocky structure; very friable; 2 percent pebbles; slightly acid; abrupt smooth boundary.

A2—10 to 15 inches; brown (10YR 5/3) sandy loam; weak fine platy structure; very friable; 2 percent pebbles; slightly acid; gradual wavy boundary.

B21t—15 to 20 inches; dark yellowish brown (10YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; thin clay films on faces of peds; 2 percent pebbles; medium acid; gradual wavy boundary.

B22t—20 to 29 inches; dark brown (10YR 4/3) sandy loam; moderate medium subangular blocky structure; firm; thin clay films on faces of peds; 2 percent pebbles; medium acid; gradual wavy boundary.

structure; firm; thin clay films on faces of peds; 2 percent pebbles; medium acid; gradual wavy boundary.

B31—35 to 44 inches; dark yellowish brown (10YR 4/6) sandy loam; weak fine subangular blocky structure; friable; 2 percent pebbles; medium acid; gradual wavy boundary.

B32—44 to 63 inches; yellowish brown (10YR 5/6) sandy loam; weak fine subangular blocky structure; friable; 2 percent pebbles; medium acid; gradual wavy boundary.

C—63 to 66 inches; yellowish brown (10YR 5/4) sandy loam; massive; friable; 5 percent pebbles; slight effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates typically are 45 to 65 inches, but the range is 40 to 80 inches. The content of pebbles ranges from 2 to 15 percent throughout. The solum ranges from slightly acid to strongly acid.

The Ap horizon has color value of 3 to 4 and chroma of 1 to 3. It is dominantly sandy loam, but the range includes fine sandy loam, loamy sand, and loam. The A2 horizon has color value of 5 or 6. Some pedons do not have an A2 horizon.

The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6.

The C horizon has color value of 5 or 6 and chroma of 3 or 4. It is dominantly sandy loam, but the range includes loamy sand. It is mildly alkaline or moderately alkaline.

Houghton series

The Houghton series consists of deep, very poorly drained, moderately slowly to moderately rapidly permeable organic soils. These soils formed in decomposed herbaceous material in bogs and other depressional areas on glacial drainageways, outwash plains, lake plains, till plains, and moraines. The slope is 0 to 2 percent.

The Houghton soils are similar to Edwards and Palms soils and are commonly adjacent to Colwood, Edwards, Gilford, and Palms soils on the landscape. The Edwards soils have marl at a depth of 16 to 50 inches. The Palms soils have loamy mineral horizons at a depth of 16 to 50 inches. The Houghton, Edwards, and Palms soils are on similar positions on the landscape. The Colwood and Gilford soils do not have organic horizons and are on slightly higher positions on the landscape than the Houghton soils.

Typical pedon of Houghton muck, 150 feet east and 250 feet south of the center of sec. 27, T. 3 S., R. 1 W., in Summit Township:

rubbed; weak medium subangular blocky structure parting to moderate fine granular; very friable; primarily herbaceous fibers; about 5 percent mineral material; neutral; abrupt smooth boundary.

Oa2—10 to 17 inches; black (N 2/0) broken face and rubbed sapric material; about 5 percent fiber, unrubbed, and less than 5 percent, rubbed; dark reddish brown (5YR 3/2) stains on faces of peds; moderate coarse subangular blocky structure; firm; primarily herbaceous fibers; about 5 percent mineral material; neutral; abrupt wavy boundary.

Oa3—17 to 22 inches; black (N 2/0) broken face and rubbed sapric material; about 25 percent fiber, unrubbed, and less than 5 percent, rubbed; massive; very friable; primarily herbaceous fibers; about 5 percent mineral material; neutral; abrupt smooth boundary.

Oa4—22 to 34 inches; black (N 2/0) broken face and rubbed sapric material; about 35 percent fiber, unrubbed, and about 5 percent, rubbed; massive; very friable; primarily herbaceous fibers; about 5 percent mineral material; slightly acid; abrupt smooth

are poorly drained and are on slightly lower positions on the landscape than the Kibbie soils. The Gilford soils are very poorly drained and are on slightly lower positions in the landscape than the Kibbie soils.

Typical pedon of Kibbie fine sandy loam, 0 to 3 percent slopes, 1,080 feet west and 1,095 feet north of the SE. corner of sec. 33, T. 3 S., R. 1 W., in Summit Township:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak coarse subangular blocky structure; very friable; slightly acid; abrupt smooth boundary.

B21t—9 to 18 inches; yellowish brown (10YR 5/4) clay loam; common medium faint dark brown (10YR 4/3) mottles; moderate medium subangular blocky structure; firm; many thick brown (10YR 5/3) and few thick light brownish gray (2.5Y 6/2) clay films on faces of peds; 2 percent pebbles; slightly acid; clear wavy boundary.

B22t—18 to 27 inches; light olive brown (2.5Y 5/4) fine sandy loam; many medium prominent yellowish brown (10YR 5/6) mottles; weak medium

Lenawee series

The Lenawee series consists of deep, poorly drained, moderately slowly permeable soils on lake plains, terraces, and old glacial drainageways and in depressional areas on moraines. These soils formed in

The Cg horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6, and chroma of 1 to 6. It is similar in texture to the B horizon. It is mildly alkaline or moderately alkaline.

Leoni series

The Leoni series consists of deep, well-drained soils

Pebbles and cobbles make up 15 to 40 percent of the A horizon and 35 to 75 percent of the B horizon. The solum ranges from medium acid to mildly alkaline.

The Ap horizon has color value of 3 or 4 and chroma

The thickness of the solum and the depth to free carbonates range from 25 to 40 inches. The content of pebbles and cobbles ranges from 2 to 10 percent throughout. In the solum, reaction ranges from medium acid to neutral. The upper part of the solum is from slightly acid to



7/6) mottles; massive; friable; few light gray (10YR 7/1) shells and shell fragments; few black (10YD 2/

material; about 60 percent fiber unrubbed, about 20 percent rubbed; massive; friable; extremely

B3—52 to 58 inches; dark brown (10YR 4/3) loamy sand; moderate fine subangular blocky structure; very friable; 10 percent pebbles; medium acid; abrupt wavy boundary.

IIC—58 to 66 inches; yellowish brown (10YR 5/4) sandy loam; massive; very friable; 15 percent pebbles; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 30 to 60 inches. Coarse fragments make up 0 to 10 percent of the solum and 0 to 30 percent of the IIC horizon. The solum ranges from

B22t—26 to 29 inches; dark brown (7.5YR 4/4) sandy clay loam; moderate medium subangular blocky structure; friable; 5 percent pebbles; common thin clay films; neutral; clear wavy boundary.

B31—29 to 42 inches; dark brown (7.5YR 4/4) loamy sand; weak fine subangular blocky structure; very friable; 1 percent pebbles; neutral; clear wavy boundary.

B32t—42 to 45 inches; dark brown (7.5YR 4/4) gravelly sandy loam; weak fine subangular blocky structure; very friable; 15 percent pebbles; few thin clay films; neutral; abrupt irregular boundary.

1,060 feet south and 30 feet east of the NW. corner of sec. 8, T. 3 S., R. 2 E., in Grass Lake Township:

Ap—0 to 10 inches; dark brown (10YR 3/3) sandy loam,

slightly lower positions on the landscape than the Owosso soils. The Marlette, Riddles, and Owosso soils are on similar positions on the landscape.

Typical pedon of Owosso sandy loam in an area of

... and other depositional areas on glacial

III C2a—46 to 60 inches: drabish brown (10YR 5/2)



prominent dark reddish brown (5YR 3/2) stains on faces of peds; 5 percent pebbles; medium acid; clear wavy boundary.

B22t—19 to 31 inches; yellowish brown (10YR 5/6) clay loam; strong medium subangular blocky structure; firm; continuous moderately thick dark brown (7.5YR 4/4) clay films on faces of peds; common fine distinct dark reddish brown (5YR 3/2) stains on faces of peds; 5 percent pebbles; medium acid; abrupt wavy boundary.

B23t—31 to 44 inches; dark yellowish brown (10YR 4/4) sandy clay loam; moderate medium subangular blocky structure; friable; common thin dark brown (7.5YR 4/4) clay films on faces of peds; 5 percent pebbles; medium acid; gradual wavy boundary.

B3—44 to 54 inches; yellowish brown (10YR 5/4) sandy loam; weak fine subangular blocky structure; friable; 10 percent pebbles; slightly acid; clear wavy boundary.

C—54 to 60 inches; yellowish brown (10YR 5/4) sandy loam; massive; friable; 3 percent pebbles; strong

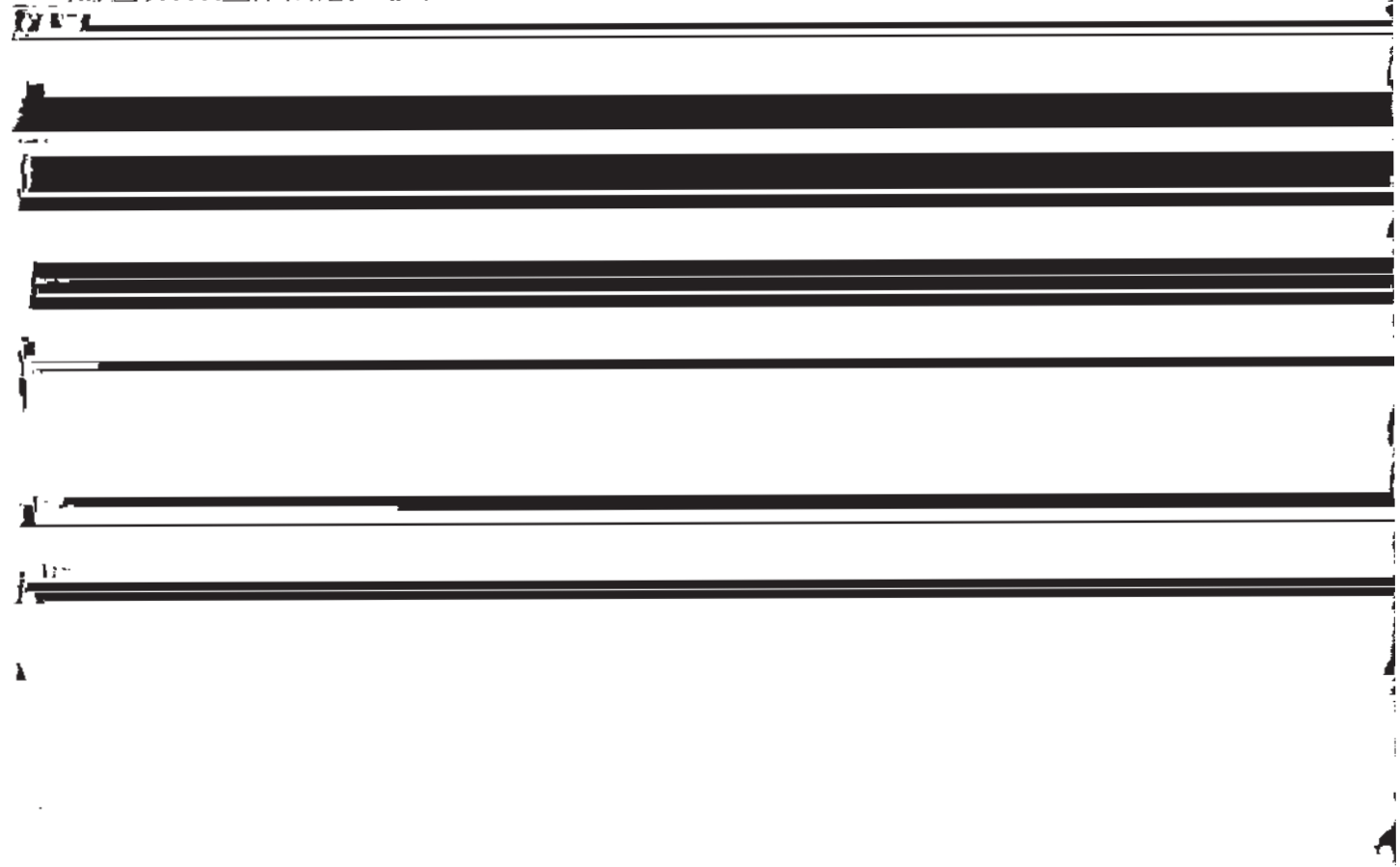
Typical pedon of Saylesville silt loam, 2 to 8 percent slopes, 1,960 feet east and 780 feet north of the SW. corner of sec. 27, T. 1 S., R. 2 E., in Waterloo Township:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; weak fine subangular blocky structure; friable; 1 percent pebbles; slightly acid; abrupt smooth boundary.

A2—8 to 10 inches; brown (10YR 5/3) loam; weak thin platy and moderate medium subangular blocky structure; friable; 1 percent pebbles; slightly acid; abrupt wavy boundary.

B21t—10 to 15 inches; yellowish brown (10YR 5/4) silty clay loam; moderate fine and medium subangular blocky structure; firm; many thin dark yellowish brown (10YR 4/4) clay films on faces of peds; few black (10YR 2/1) stains on faces of peds; 1 percent pebbles; slightly acid; clear wavy boundary.

B22t—15 to 22 inches; dark brown (10YR 4/3) silty clay loam; moderate medium angular blocky structure parting to strong fine angular blocky; firm; many thin clay films on faces of peds; few black (10YR 2/1)



The thickness of the solum and the depth to free carbonates range from 40 to 70 inches. The content of pebbles is 0 to 10 percent throughout. The solum ranges from extremely acid to neutral.

stains on faces of peds; 1 percent pebbles; neutral; abrupt smooth boundary.

C—22 to 60 inches; brown (10YR 5/3) silty clay loam; weak fine subangular blocky structure; firm; few light brown (10YR 7/8) clay films on faces of peds; 1 percent

the B horizon. The Colwood, Gilford, and Sebewa soils are on similar positions on the landscape.

Typical pedon of Sebewa loam, 1,860 feet east and 255 feet south of the NW. corner of sec. 30, T. 2 S., R. 1 W., in Blackman Township:

- Ap—0 to 10 inches; black (10YR 2/1) loam, gray (10YR 5/1) dry; moderate fine subangular blocky structure; friable; slightly acid; abrupt smooth boundary.
- A12g—10 to 15 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; moderate fine subangular blocky structure; friable; neutral; clear wavy boundary.
- B21tg—15 to 26 inches; dark gray (10YR 4/1) clay loam; common fine prominent strong brown (7.5YR 5/6) mottles; coarse medium subangular blocky structure; firm; continuous thick very dark gray (10YR 3/1) clay films on faces of peds; 2 percent pebbles; neutral; clear wavy boundary.
- B22tg—26 to 33 inches; gray (10YR 5/1) clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; continuous thick very dark gray (10YR 3/1) clay films on faces of peds; 2 percent pebbles; neutral; clear wavy boundary.
- B3g—33 to 35 inches; gray (10YR 5/1) sandy loam; fine medium prominent yellowish brown (10YR 5/6) mottles; fine medium subangular blocky structure; friable; 2 percent pebbles; neutral; clear wavy boundary.
- IIC1g—35 to 50 inches; gray (10YR 6/1) sand; single grain; loose; slight effervescence; 10 percent pebbles; mildly alkaline; abrupt wavy boundary.
- IIC2g—50 to 60 inches; light brownish gray (10YR 6/2) sand; single grain; loose; 10 percent pebbles; strong effervescence; moderately alkaline.

The solum is 20 to 40 inches thick. Free carbonates are at a depth of 18 to 36 inches. The mollic epipedon is 10 to 15 inches thick. The content of pebbles ranges from 0 to 15 percent in the upper part of the solum, from 5 to 25 percent in the lower part of the solum, and from 5 to 60 percent in the IIC horizon. The solum ranges from slightly acid to mildly alkaline.

The Ap horizon has color value of 2 or 3 and chroma of 1 or 2. It ranges in thickness from 8 to 11 inches. It is dominantly loam, but the range includes sandy loam. The A12g horizon has color value of 2 or 3 and chroma of 1 or 2. It is dominantly loam, but the range includes sandy loam. Some pedons do not have an A12g horizon.

The B2tg horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 or 2. It is dominantly clay loam, but the range includes sandy clay loam, gravelly clay loam, and gravelly loam. Some pedons do not have a B3g horizon.

The IICg horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6, and chroma of 1 or 2. It is sand or gravelly sand. It is mildly alkaline or moderately alkaline.

Spinks series

The Spinks series consists of deep, well drained, moderately rapidly and rapidly permeable soils on moraines, eskers, outwash plains, and till plains. These soils formed in sandy glaciofluvial deposits. The slope ranges from 0 to 25 percent.

The Spinks soils are similar to Arkport soils and are commonly adjacent to Boyer, Ormas, and Oshtemo soils on the landscape. The Arkport soils have a B horizon that consists of lamellae. The Boyer, Ormas, and Oshtemo soils have finer textured, continuous Bt horizons that typically contain more gravel. The Arkport, Boyer, Ormas, Oshtemo, and Spinks soils are on similar positions on the landscape.

Typical pedon of Spinks sand, 0 to 6 percent slopes, 100 feet south and 1,910 feet east of the center of sec. 36, T. 3 S., R. 1 W., in Summit Township:

- Ap—0 to 6 inches; dark brown (10YR 4/3) sand; moderate fine granular structure; very friable; medium acid; abrupt smooth boundary.
- A21—6 to 18 inches; brownish yellow (10YR 6/6) sand; single grain; loose; medium acid; gradual wavy boundary.
- A22—18 to 29 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; medium acid; abrupt wavy boundary.
- A&B—29 to 60 inches; light yellowish brown (10YR 6/4) sand (A2); single grain; loose; bands of dark brown (7.5YR 4/4) fine sand (B2t); weak medium subangular blocky structure; friable; discontinuous bands, 1 inch to 5 inches thick, that have a cumulative thickness of more than 6 inches; slightly acid.

The thickness of the solum and the depth to free carbonates range from 40 to more than 60 inches. The content of pebbles ranges from 0 to 15 percent throughout. The solum ranges from medium acid to mildly alkaline.

The Ap horizon has color value of 3 or 4 and chroma of 2 or 3. It is dominantly sand, but the range includes fine sand and loamy sand. The A2 horizon has color value of 5 or 6 and chroma of 4 to 6. It is sand, fine sand, or loamy sand.

In the A&B horizon the A part is similar in color and texture to the A2 horizon. The B part has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The bands of the B part are dominantly sand, but the range includes loamy sand and loamy fine sand. These bands are 1/8 inch to 5 inches thick, are often discontinuous, and have cumulative thickness of more than 6 inches. The first band of the B horizon is at a depth of 15 to about 36 inches.

Teasdale series

The Teasdale series consists of deep, somewhat poorly drained, moderately permeable soils on till plains and moraines. These soils formed in loamy glacial till. The slope ranges from 0 to 3 percent.

The Teasdale soils are commonly adjacent to Barry, Hillsdale, and Riddles soils on the landscape. The Barry soils are poorly drained and are on lower positions on the landscape than the Teasdale soils. The Hillsdale and Riddles soils are well drained and are on higher positions on the landscape than the Teasdale soils.

Typical pedon of Teasdale fine sandy loam, 0 to 3 percent slopes, 1,400 feet west and 600 feet south of the NE. corner of sec. 3, T. 3 S., R. 2 W., in Spring Arbor Township:

Ap—0 to 9 inches; dark brown (10YR 3/3) fine sandy loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; 5 percent cobbles, 2 percent pebbles; medium acid; abrupt smooth boundary.

A2—9 to 13 inches; yellowish brown (10YR 5/4) fine sandy loam; few fine faint dark yellowish brown (10YR 4/4) and common medium faint brown (10YR 5/3) and pale brown (10YR 6/3) mottles; moderate thin platy structure parting to weak medium granular; friable; 2 percent cobbles, 2 percent pebbles; strongly acid; gradual wavy boundary.

B&A—13 to 24 inches; brown (10YR 5/3) fine sandy loam (A2), gray (10YR 7/2) dry; weak medium granular structure; friable; interfingering into dark yellowish brown (10YR 4/4) fine sandy loam (B); common medium faint brown (10YR 5/3) mottles; moderate medium granular structure; friable; 10 percent cobbles, 5 percent pebbles; slight effervescence; moderately alkaline.

5/6) mottles; massive; friable; 10 percent cobbles, 5 percent pebbles; slight effervescence; moderately alkaline.

The solum is 40 to 60 inches thick. Free carbonates are at a depth of 40 to more than 60 inches. The content of pebbles and cobbles ranges from 2 to 20 percent throughout.

The Ap horizon has color value of 3 or 4 and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes loam and sandy loam. The A2 horizon has color value of 5 or 6 and chroma of 2 to 5. It is similar in texture to the Ap horizon. The A horizon ranges from strongly acid to slightly acid.

In the B&A horizon, coatings of A2 material, 2 to 5 millimeters thick, are on the vertical faces of peds. The B part has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is fine sandy loam, loam, sandy loam, or the gravelly or cobbly phases.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is fine sandy loam, sandy loam, loam, clay loam, or the gravelly or cobbly phases. Reaction ranges from strongly acid to neutral.

The C horizon is fine sandy loam, sandy loam, or the gravelly and cobbly phases. Reaction ranges from neutral to moderately alkaline.

Wauseon series

The Wauseon series consists of deep, very poorly drained soils that are moderately rapidly permeable and rapidly permeable in the solum and very slowly permeable in the substratum. These soils are on lake

structure; very friable; mildly alkaline; clear smooth boundary.

A12—10 to 13 inches; black (10YR 2/1) loam; dark gray (10YR 4/1) dry; common medium distinct grayish brown (10YR 5/2) and few fine prominent yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; very friable; mildly alkaline; clear wavy boundary.

B21g—13 to 26 inches; grayish brown (10YR 5/2) sandy loam; many medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; 10 percent pebbles; mildly alkaline; gradual smooth boundary.

B22g—26 to 36 inches; gray (10YR 5/1) gravelly sandy loam; common medium distinct yellowish brown (10YR 5/4) and many medium prominent yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; very friable; 25 percent pebbles; mildly alkaline; abrupt smooth boundary.

Eleva, Hillsdale, Riddles, and Whalan soils are on similar positions on the landscape.

Typical pedon of Whalan loam, 1 to 6 percent slopes, 1,000 feet north and 200 feet east of the center of sec. 30, T. 2 S., R. 2 W., in Sandstone Township:

Ap—0 to 9 inches; dark brown (10YR 4/3) loam; moderate fine subangular blocky structure; friable; 2 percent pebbles; neutral; abrupt smooth boundary.

B1—9 to 11 inches; dark yellowish brown (10YR 4/4) loam; moderate fine subangular blocky structure; friable; 2 percent pebbles; neutral; clear wavy boundary.

B21t—11 to 21 inches; dark brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; many clay films on faces of peds; 2 percent pebbles; neutral; clear wavy boundary.

11B22t—21 to 26 inches; dark brown (7.5YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; many clay films on faces of peds; 2

Gilford, and Wauseon soils are very poorly drained or poorly drained and are on lower positions on the landscape than the Ypsi soils.

Typical pedon of Ypsi sandy loam in an area of Ypsi-Wauseon complex, 0 to 3 percent slopes, 225 feet west

B3—25 to 29 inches; yellowish brown (10YR 5/8) gravelly sandy loam; few fine and medium prominent grayish brown (10YR 5/8) mottles; weak medium subangular blocky structure; very friable; very dark gray (10YR 2/1) wormcasted channels; 8%

formation of the soils

The paragraphs that follow describe the factors of soil formation, relate them to the formation of soils in the survey area, and explain the processes of soil formation.

factors of soil formation

Soil is formed through the interaction of five major factors: the physical, chemical, and mineral composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the processes of soil formation have acted on the parent material (3).

Climate and plant and animal life are the active forces in soil formation. They slowly change the parent material into a natural body of soil that has genetically related layers, called horizons. The effects of climate and plant and animal life are modified by relief. The nature of the parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed to change the parent material into soil. It may be long or short, but some time is required for differentiation of soil horizons. Generally, a long time is required for the formation of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soils that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil formation are unknown.

parent material

Parent material is the unconsolidated mass from which a soil forms. Most of the parent materials of the soils in Jackson County were deposited by glaciers or by melt water from the glaciers, which covered the county about 10,000 to 12,000 years ago. Some of these materials have been reworked and redeposited by subsequent action of water and wind. Parent material determines the chemical and mineralogical composition of the soil. Although the parent materials are of a common glacial origin, their properties vary greatly, sometimes within a small area, depending on how the materials were deposited. The dominant parent materials in Jackson County were deposited as glacial till, outwash deposits, lacustrine deposits, alluvium, and organic material.

Glacial till is material that was deposited directly by glaciers with a minimum of water action. It is a mixture of particles of different sizes. The small pebbles in glacial till have sharp corners, indicating that they have not been worn by water. The glacial till in Jackson County is calcareous loam or sandy loam. The Marlette soils are an example of soils that formed in this glacial till. They typically have a moderately fine texture and a well developed subsoil.

Outwash material is deposited by running water from melting glaciers. The size of the particles varies according to the speed of the stream that carried them. As the water slows down, the coarser particles are deposited. Only the finer particles, such as very fine sand, silt, and clay, can be carried by slowly moving water. Outwash deposits generally consist of layers of particles of similar size, such as sandy loam, sand, gravel, and other coarse particles. The Boyer soils, for example, formed in deposits of outwash material.

Lacustrine material is deposited from still, or ponded glacial melt water. Because the coarser fragments drop out of the moving water as outwash, only the finer particles, such as very fine sand, silt, and clay, remain to settle out in still water. In Jackson County the soils that formed in lacustrine deposits are typically medium textured, moderately fine textured, and fine textured. The Lenawee soils, for example, formed in lacustrine material.

Alluvium is material recently deposited by the floodwaters of streams. This material varies in texture, depending on the speed of the water from which it was deposited. The Cohoctah soils are an example of alluvial soils.

Organic material is made up of deposits of plant remains. After the glaciers withdrew from the survey area, water was left standing in depressions in the outwash plains, flood plains, moraines, and till plains. Because of the wetness the grasses, sedges, and water-tolerant trees that grew around the edge of these depressions did not decompose quickly after they died. Eventually the plant residue filled the depressions and decomposed to form muck. Houghton soils, for example, formed in organic material.

The parent materials of some of the soils in Jackson County were formed in place through the disintegration and decomposition of sedimentary rocks. The unconsolidated mass of weathered bedrock is called residuum. Whalan soils, for example, formed in loamy

glacial drift and a thin layer of silty or clayey residuum of

slowly through soils that are very poorly drained. In soils

parent material

plant and animal life

Green plants have been the principal organisms influencing soil formation in Jackson County. Bacteria, fungi, earthworms, and the activities of man have also been important. The chief contribution of plant and animal life is the addition of organic matter and nitrogen to the soil. The kind of organic material on and in the soil depends on the kinds of plants that grew on the soil. The remains of these plants accumulate on the surface, decay, and eventually become organic matter. Roots of the plants provide channels for downward movement of water through the soil and also add organic matter as they decay. Bacteria in the soil help to break down the organic matter so that it can be used by growing plants.

The vegetation in Jackson County was mainly deciduous forest. Differences in natural soil drainage and minor changes in parent material affected the composition of the forest species.

In general, the well drained upland soils, such as the Boyer, Marlette, and Oshtemo soils, were mainly covered by sugar maple, oak, and hickory trees. The poorly drained and very poorly drained soils were covered mainly by soft maple, elm, and ash. The Colwood and Gilford soils formed under wet conditions, and they contain a considerable amount of organic matter.

climate

Climate determines the kind of plant and animal life on and in the soil. It also determines the amount of water available for the weathering of minerals and for the

which give most of the soils their color, are brightly colored and oxidized. In poorly aerated soils the color is dull gray and mottled. The Saylesville soils are well drained, well aerated soils. The Lenawee soils are poorly aerated, poorly drained soils. The Saylesville and Lenawee soils formed in similar parent material.

time

In general, a long time is required for the development of distinct horizons from parent material. The differences in the length of time that parent material has been in place commonly are reflected in the degree of development of the soil profile. Some soils develop rapidly, others slowly.

The soils in Jackson County range from young to mature. The glacial deposits in which many of the soils in Jackson County formed have been exposed to soil-forming factors long enough that distinct horizons have developed. The soils that formed in recent alluvial sediments, however, have not been in place long enough for distinct horizons to develop.

The Cohoctah soils are an example of young soils that formed in alluvial material. The Riddles soils are an example of soils that are old enough that distinct horizons have formed and lime (calcium carbonate) has leached from the solum.

processes of soil formation

The processes responsible for the development of the soil horizons from the unconsolidated parent material are

soils are leached of carbonates to a depth of 54 inches, whereas, Marlette soils are leached to a depth of only 32 inches. This difference in the depth of leaching is a result of time and parent material as soil-forming factors.

The reduction and transfer of iron, a process called gleying, is evident in the somewhat poorly drained, poorly drained, and very poorly drained soils. The gray subsoil indicates the reduction and loss of iron. Lenawee soils, for example, are strongly gleyed.

The translocation of clay minerals has contributed to horizon development. The eluviated, or leached, A2 horizon typically has a platy structure, is lower in content

of clay, and typically is lighter in color than the illuviated B horizon. The B horizon typically has an accumulation of clay, or clay films, in pores and on the faces of peds. These soils were probably leached of carbonates and soluble salts to a considerable extent before the translocation of silicate clays. The leaching of bases and the translocation of silicate clays are among the more important processes in horizon differentiation in soils. The Marlette soils are an example of soils that have translocated silicate clays in the form of clay films accumulated in the B horizon.

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glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	<i>Inches</i>
Very low.....	0 to 3
Low.....	3 to 6
Moderate.....	6 to 9
High.....	9 to 12
Very high.....	more than 12

Bedrock. The solid rock that underlies the soil and other

not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Congeliturbate. Soil material disturbed by frost action.

Conservation tillage. A tillage system that does not invert the soil and that leaves all or part of the crop residue on the surface throughout the year.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A plant growing over a crop primarily to

Well drained.—Water is removed from the soil so readily that the upper 40 inches generally does not have the mottles or dull colors related to wetness.

Moderately well drained.—Water is removed from the soil so slowly that the upper 20 to 40 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Somewhat poorly drained.—Water is removed from the soil so slowly that the upper 10 to 20 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Poorly drained.—Water is removed so slowly that

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in

forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Stratified sand and gravel produced

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid.....	below 4.5
Very strongly acid.....	4.5 to 5.0
Strongly acid.....	5.1 to 5.5
Medium acid.....	5.6 to 6.0
Slightly acid.....	6.1 to 6.5
Neutral.....	6.6 to 7.3
Mildly alkaline.....	7.4 to 7.8
Moderately alkaline.....	7.9 to 8.4
Strongly alkaline.....	8.5 to 9.0
Very strongly alkaline.....	9.1 and higher

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A1, A2, or A3) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series that they most closely resemble.

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION
[Recorded in the period 1948-77 at Jackson, Michigan]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have--		Average number of growing degree days*	Average	2 years in 10 will have--		Average number of days with 0.10 inch or more	Snowfall
				Maximum temperature higher than--	Minimum temperature lower than--			Less than--	More than--		
	<u>°F</u>	<u>°F</u>	<u>°F</u>	<u>°F</u>	<u>°F</u>		<u>In</u>	<u>In</u>	<u>In</u>		<u>In</u>
January----	29.5	15.0	22.2	57	-12	0	1.69	0.9	2.4	4	8.6
February---	32.8	17.0	24.9	57	-11	0	1.73	0.8	2.5	5	7.4
March-----	42.1	25.1	33.6	74	0	13	2.33	1.3	3.3	6	7.1
April-----	57.2	36.4	46.8	82	17	92	3.04	2.0	4.0	7	1.8
May-----	69.0	46.4	57.7	88	28	275	2.91	1.7	4.0	6	**
June-----	78.8	56.6	67.7	95	38	539	3.53	2.2	4.7	7	0
July-----	82.8	60.6	71.7	97	46	682	3.18	2.0	4.3	6	0
August-----	81.1	58.8	69.9	95	42	626	2.73	1.4	3.9	5	0
September--	73.1	51.4	62.3	93	31	381	2.32	1.3	3.3	6	**
October----	62.2	41.3	51.8	85	21	151	2.12	.8	3.2	5	**
November---	46.1	31.1	38.6	72	6	24	2.22	1.5	2.9	6	4.1
December---	33.8	20.3	27.1	61	-7	0	1.90	.9	2.7	5	8.5
Year-----	57.4	38.3	47.9	98	-14	2,783	29.70	25.7	33.5	68	37.4

* A growing degree day is an index of the amount of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

** Trace

TABLE 2.--FREEZE DATES IN SPRING AND FALL
[Recorded in the period 1930-74 at Jackson, Michigan]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 24	May 5	May 21
2 years in 10 later than--	April 19	May 1	May 17
5 years in 10 later than--	April 9	April 23	May 8
First freezing temperature in fall:			
1 year in 10 earlier than--	October 18	October 5	September 22
2 years in 10 earlier than--	October 24	October 10	September 26
5 years in 10 earlier than--	November 5	October 21	October 6

TABLE 3.--GROWING SEASON
[Recorded in the period 1930-74 at Jackson,
Michigan]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	184	161	132
8 years in 10	194	168	138
5 years in 10	209	181	150
2 years in 10	226	194	162
1 year in 10	235	201	169

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
11B	Boyer-Oshtemo sandy loams, 1 to 6 percent slopes-----	14,040	2.9
11C	Boyer-Oshtemo sandy loams, 6 to 12 percent slopes-----	8,410	1.8
11D	Boyer-Oshtemo sandy loams, 12 to 18 percent slopes-----	2,940	0.6
11E	Boyer-Leoni complex, 18 to 40 percent slopes-----	825	0.2
13B	Ormas-Spinks complex, 0 to 6 percent slopes-----	27,615	6.0
13C	Ormas-Spinks complex, 6 to 12 percent slopes-----	14,505	3.2
13D	Ormas-Spinks complex, 12 to 25 percent slopes-----	4,125	0.9
14B	Spinks sand, 0 to 6 percent slopes-----	11,770	2.6
14C	Spinks sand, 6 to 12 percent slopes-----	6,010	1.3
14D	Spinks sand, 12 to 25 percent slopes-----	2,765	0.6
15A	Teasdale fine sandy loam, 0 to 3 percent slopes-----	14,510	3.2
16A	Brady sandy loam, 0 to 3 percent slopes-----	11,510	2.5
17	Barry loam-----	8,485	1.8
18	Gilford-Colwood complex-----	20,670	4.5
20	Houghton muck-----	37,530	8.2
22	Cohoctah fine sandy loam-----	3,445	0.8
29A	Kibble fine sandy loam, 0 to 3 percent slopes-----	1,745	0.4
30	Edwards muck-----	6,390	1.4
35B	Arkport-Okee loamy fine sands, 2 to 6 percent slopes-----	12,200	2.7
35C	Arkport-Okee loamy fine sands, 6 to 12 percent slopes-----	8,490	1.9
35D	Arkport-Okee loamy fine sands, 12 to 25 percent slopes-----	2,235	0.5
37	Palms muck-----	22,990	5.0
39A	Ypsi-Wauseon complex, 0 to 3 percent slopes-----	1,100	0.2
40	Lenawee silt loam-----	1,905	0.4
42A	Riddles sandy loam, 0 to 2 percent slopes-----	3,460	0.8
42B	Riddles sandy loam, 2 to 6 percent slopes-----	33,560	7.3
42C	Riddles sandy loam, 6 to 12 percent slopes-----	12,950	2.8
42D	Riddles sandy loam, 12 to 18 percent slopes-----	2,905	0.6
43A	Dixboro very fine sandy loam, 0 to 3 percent slopes-----	9,475	2.1
44B	Leoni gravelly sandy loam, 2 to 6 percent slopes-----	4,545	1.0
44C	Leoni gravelly sandy loam, 6 to 12 percent slopes-----	3,720	0.8
44D	Leoni gravelly sandy loam, 12 to 18 percent slopes-----	1,350	0.3
45	Martisco muck-----	2,110	0.5
46	Sebewa loam-----	4,155	0.9
47	Histosols and Aquents, ponded-----	5,420	1.2
48	Napoleon muck-----	3,670	0.8
49B	Hillsdale-Riddles sandy loams, 1 to 6 percent slopes-----	43,020	9.4
49C	Hillsdale-Riddles sandy loams, 6 to 12 percent slopes-----	23,080	5.0
49D	Hillsdale-Riddles sandy loams, 12 to 18 percent slopes-----	5,045	1.1
49E	Hillsdale-Riddles sandy loams, 18 to 30 percent slopes-----	4,840	1.1
51	Udorthents and Udipsamments, nearly level-----	3,155	0.7
52	Pits, gravel-----	1,115	0.2
53	Pits, quarries-----	105	*
55B	Eleva sandy loam, 1 to 6 percent slopes-----	5,095	1.1
55C	Eleva sandy loam, 6 to 12 percent slopes-----	1,065	0.2
56D	Riddles-Leoni complex, 10 to 20 percent slopes-----	1,720	0.4
57A	Urban land-Barry-Brady complex, 0 to 3 percent slopes-----	2,130	0.5
58B	Urban land-Oshtemo complex, 0 to 6 percent slopes-----	3,720	0.8
58C	Urban land-Oshtemo complex, 6 to 15 percent slopes-----	1,040	0.2
59B	Urban land-Riddles complex, 0 to 6 percent slopes-----	1,565	0.3
59C	Urban land-Riddles complex, 6 to 15 percent slopes-----	440	0.1
60	Urban land-Udorthents complex-----	1,650	0.4
61B	Saylesville silt loam, 2 to 8 percent slopes-----	520	0.1
62A	Del Rey silt loam, 0 to 3 percent slopes-----	1,015	0.2
63	Henrietta muck-----	4,155	0.9
64B	Marlette-Owosso complex, 2 to 6 percent slopes-----	4,530	1.0
64C	Marlette-Owosso complex, 6 to 12 percent slopes-----	2,065	0.5
65A	Capac loam, 0 to 3 percent slopes-----	3,055	0.7
66E	Eleva Variant channery fine sandy loam, 15 to 30 percent slopes-----	440	0.1
67B	Whalan loam, 1 to 6 percent slopes-----	420	0.1
68B	Oshtemo-Leoni complex, 1 to 6 percent slopes-----	3,290	0.7
68C	Oshtemo-Leoni complex, 6 to 12 percent slopes-----	2,050	0.4
	Water-----	5,025	1.1
	Total-----	458,880	100.0

* Less than 0.1 percent.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Corn silage	Oats	Winter wheat	Soybeans	Grass- legume hay
	Bu	Ton	Bu	Bu	Bu	Ton
11B----- Boyer-Oshtemo	80	13	60	35	30	3.0
11C----- Boyer-Oshtemo	75	12	55	32	26	2.7
11D----- Boyer-Oshtemo	65	11	51	27	21	2.3
11E----- Boyer-Leoni	---	---	---	---	---	---
13B----- Ormas-Spinks	63	9	60	30	24	2.4
13C----- Ormas-Spinks	56	8	55	29	21	2.1
13D----- Ormas-Spinks	---	---	---	25	---	1.7
14B----- Spinks	65	9	60	30	27	3.0
14C----- Spinks	57	8	55	30	23	2.4
14D----- Spinks	---	---	---	---	---	1.8
15A----- Teasdale	105	17	90	50	33	4.8
16A----- Brady	80	12	60	35	30	3.0
17----- Barry	110	17	95	55	35	4.5
18----- Gillford-Colwood	109	17	81	55	37	4.6
20----- Houghton	115	20	---	---	34	---
22----- Cohoctah	---	---	---	---	---	3.5
29A----- Kibbie	110	18	80	50	40	4.0
30----- Edwards	90	15	---	---	34	---
35B----- Arkport-Okee	81	16	68	45	30	3.5
35C----- Arkport-Okee	68	12	55	42	26	3.0
35D----- Arkport-Okee	55	10	45	---	---	2.7
37----- Palms	105	17	65	---	42	---

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Oats	Winter wheat	Soybeans	Grass- legume hay
	Bu	Ton	Bu	Bu	Bu	Ton
39A----- Ypsil-Wauseon	108	17	84	52	40	3.9
40----- Lenawee	125	19	100	60	42	4.0
42A----- Riddles	120	19	90	48	42	4.0
42B----- Riddles	115	18	88	46	40	3.8
42C----- Riddles	105	17	84	42	37	3.4
42D----- Riddles	90	---	---	36	32	3.0
43A. Dixboro						
44B----- Leon1	70	12	50	30	28	2.5
44C----- Leon1	65	11	45	28	24	2.2
44D----- Leon1	50	10	40	24	21	2.0
45----- Martisco	90	18	---	---	---	---
46----- Sebewa	105	17	90	50	36	4.6
47----- Histosols and Aquents	---	---	---	---	---	---
48----- Napoleon	---	---	---	---	---	---
49B----- Hillsdale-Riddles	103	17	90	43	37	3.9
49C----- Hillsdale-Riddles	91	16	86	38	34	3.6
49D----- Hillsdale-Riddles	79	---	75	33	31	3.1
49E----- Hillsdale-Riddles	---	---	---	---	---	2.8
51----- Udorthents and Udipsamments	---	---	---	---	---	---
52, 53. Pits						
55B----- Eleva	75	12	65	---	---	4.0
55C----- Eleva	75	12	65	---	---	4.0
56D-----	76	---	---	32	28	2.7

TABLE 5.--YTRIDS PER ACRE OF CROPS AND PASTURE--Continued

[illegible]

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		<u>Acres</u>	<u>Acres</u>	<u>Acres</u>
I	3,460	---	---	---
II	176,030	94,250	81,780	---
III	209,220	72,935	60,520	75,765
IV	24,695	16,195	8,500	---
V	3,445	---	3,445	---
VI	15,840	11,730	3,670	440
VII	825	825	---	---
VIII	5,420	---	5,420	---

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	
11B*, 11C*, 11D*: Boyer-----	2o	Slight	Slight	Slight	Slight	Northern red oak---- White oak----- American basswood---- Sugar maple-----	66 --- --- ---	Eastern white pine, red pine, white spruce.
Oshtemo-----	2o	Slight	Slight	Slight	Slight	Northern red oak---- White oak----- American basswood---- Sugar maple-----	66 --- 66 61	Eastern white pine, red pine, white spruce.
11E*: Boyer-----	2r	Moderate	Moderate	Slight	Slight	Northern red oak---- White oak----- American basswood---- Sugar maple-----	66 --- --- ---	Eastern white pine, red pine, white spruce.
Leon1-----	2r	Moderate	Moderate	Slight	Slight	Northern red oak---- White oak----- American basswood---- Sugar maple----- White ash----- Black walnut----- Black cherry-----	65 --- 65 61 65 65 ---	Red pine, eastern white pine, white spruce, Austrian pine.
13B*, 13C*, 13D*: Ormas-----	2s	Slight	Slight	Moderate	Slight	Black oak----- White oak----- Bigtooth aspen----- Black cherry----- Yellow-poplar-----	65 66 75 --- ---	Black walnut, Norway spruce, red pine, eastern white pine, yellow-poplar.
Spinks-----	2s	Slight	Slight	Moderate	Slight	Northern red oak---- White oak----- Shagbark hickory---- Black oak----- Black cherry-----	66 66 66 66 66	Red pine, eastern white pine.
14B, 14C: Spinks	2s	Slight	Slight	Severe	Slight	Northern red oak---- White oak----- Shagbark hickory---- Black oak----- Black cherry-----	66 66 66 66 66	Red pine, eastern white pine.
14D: Spinks	2s	Moderate	Moderate	Severe	Slight	Northern red oak---- White oak----- Shagbark hickory---- Black oak----- Black cherry-----	66 66 66 66 66	Red pine, eastern white pine.
15A: Teasdale	2o	Slight	Slight	Slight	Slight	Northern red oak---- Red maple----- White ash----- Eastern cottonwood-- American basswood---- Northern pin oak----	66 66 66 101 --- ---	White spruce, eastern white pine.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	
16A----- Brady	3o	Slight	Slight	Slight	Slight	Red maple----- White ash----- Quaking aspen----- Silver maple----- Bitternut hickory--- Swamp white oak----- American basswood---	56 56 60 82 --- --- 56	White spruce, northern white-cedar, eastern white pine, Norway spruce.
17----- Barry	3w	Slight	Severe	Severe	Severe	Red maple----- White ash----- Eastern cottonwood-- Silver maple----- Swamp white oak----- American sycamore--- Bitternut hickory--- Pin oak-----	56 56 91 82 --- --- --- ---	Carolina poplar, eastern white pine.
18*: Gilford-----	3w	Slight	Severe	Severe	Severe	Red maple----- Silver maple----- American basswood--- Pin oak----- White ash----- Swamp white oak----- Bur oak-----	56 --- --- --- --- --- ---	Eastern white pine, Norway spruce, white spruce.
Colwood-----	3w	Slight	Severe	Severe	Severe	Red maple----- White ash----- Silver maple----- Green ash----- Swamp white oak-----	56 56 82 56 56	Eastern white pine.
20----- Houghton	3w	Slight	Severe	Severe	Severe	Red maple----- Silver maple----- White ash----- Quaking aspen----- Tamarack----- Green ash----- Northern white-cedar Swamp white oak-----	56 82 56 60 45 --- 27 ---	
22----- Cohoctah	3w	Slight	Severe	Severe	Severe	Red maple----- Eastern cottonwood-- Silver maple----- White ash----- Swamp white oak----- American sycamore--- Pin oak----- Bitternut hickory---	56 91 82 66 --- --- --- ---	Carolina poplar, eastern white pine.
29A----- Kibbie	2o	Slight	Slight	Slight	Slight	Northern red oak---- White oak----- White ash----- American basswood--- Quaking aspen----- Pin oak----- Sugar maple-----	66 --- 66 66 70 --- ---	White spruce, eastern white pine, Norway spruce.
30----- Edwards	3w	Slight	Severe	Severe	Severe	Red maple----- White ash----- Green ash----- Black cherry----- Swamp white oak----- Silver maple----- Tamarack-----	56 56 56 --- --- 82 45	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	
35B*, 35C*: Arkport-----	2s	Slight	Slight	Moderate	Slight	Sugar maple----- Red pine----- Eastern white pine--	70 85 85	Norway spruce, red pine, eastern white pine.
Okee-----	3s	Slight	Slight	Moderate	Slight	Northern pin oak---- Black oak-----	55 ---	Red pine.
35D*: Arkport-----	2s	Moderate	Moderate	Moderate	Slight	Sugar maple----- Eastern white pine-- Red pine----- Northern red oak----	70 85 85 75	Norway spruce, eastern white pine, red pine.
Okee-----	3s	Moderate	Moderate	Moderate	Slight	Northern pin oak---- Black oak-----	55 ---	Red pine.
37----- Palms	3w	Slight	Severe	Severe	Severe	Red maple----- Silver maple----- White ash----- Quaking aspen----- Northern white-cedar Tamarack----- Black ash-----	55 76 51 56 27 45 ---	
39A*: Ypsi-----	3o	Slight	Slight	Slight	Slight	Northern red oak---- White ash----- White oak----- American basswood--- Red maple----- Eastern cottonwood--	56 56 --- 56 --- ---	Eastern white pine, white spruce.
Wauseon-----	3w	Slight	Severe	Severe	Severe	Silver maple----- White ash----- Swamp white oak----	70 --- ---	White spruce.
40----- Lenawee	3w	Slight	Severe	Severe	Moderate	Red maple----- White ash----- American basswood--- Silver maple-----	66 66 66 81	White spruce, Norway spruce, eastern white pine.
42A, 42B, 42C, 42D Riddles	2o	Slight	Slight	Slight	Slight	Northern red oak---- Red maple----- White ash----- Green ash-----	65 65 65 65	Red pine, white spruce.
43A----- Dixboro	2o	Slight	Slight	Slight	Slight	Northern red oak---- White oak----- Northern pin oak---- Black oak----- Shagbark hickory----	65 --- --- --- ---	Eastern white pine, white spruce.
44B, 44C, 44D----- Leoni	2o	Slight	Slight	Slight	Slight	Northern red oak---- White oak----- American basswood--- Sugar maple----- White ash----- Black walnut----- Black cherry-----	65 --- 65 61 65 65 ---	Red pine, eastern white pine, white spruce.
45----- Martisco	5w	Slight	Severe	Severe	Severe	Red maple-----	40	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	
46----- Sebewa	2w	Slight	Severe	Moderate	Moderate	Red maple----- White ash----- American basswood--- Swamp white oak----- Pin oak----- Northern red oak----	66 66 --- --- 66 66	White spruce, eastern white pine, Norway spruce.
48----- Napoleon	3w	Slight	Severe	Severe	Severe	Red maple----- Silver maple----- White ash----- Quaking aspen----- Tamarack----- Green ash-----	56 76 56 60 45 56	
49B*, 49C*, 49D*: Hillsdale-----	2o	Slight	Slight	Slight	Slight	Northern red oak---- Black walnut----- White ash----- Sugar maple----- Black cherry----- American basswood--- Yellow-poplar-----	66 --- --- --- --- --- ---	Black walnut, eastern white pine, white spruce, red pine, yellow-poplar.
Riddles-----	2o	Slight	Slight	Slight	Slight	Northern red oak---- Red maple----- White ash----- Green ash----- Black walnut----- Yellow-poplar-----	65 65 65 65 --- ---	Black walnut, red pine, white spruce.
49E*: Hillsdale-----	2r	Moderate	Moderate	Slight	Slight	Northern red oak---- Black walnut----- White ash----- Sugar maple----- Black cherry----- American basswood--- Yellow-poplar-----	65 --- --- --- --- --- ---	Black walnut, eastern white pine, white spruce, red pine, yellow-poplar.
Riddles-----	2r	Moderate	Moderate	Slight	Slight	Northern red oak---- Red maple----- White ash----- Green ash----- Black walnut----- Yellow-poplar-----	65 65 65 65 --- ---	Black walnut, red pine, white spruce.
55B, 55C----- Eleva	2o	Slight	Slight	Slight	Slight	Black oak----- Jack pine----- Northern pin oak----- Northern red oak----	65 --- --- ---	Red pine.
56D*: Riddles-----	2o	Slight	Slight	Slight	Slight	Northern red oak---- Red maple----- White ash----- Green ash----- Black walnut----- Yellow-poplar-----	65 65 65 65 --- ---	Black walnut, red pine, white spruce.
Leoni-----	2o	Slight	Slight	Slight	Slight	Northern red oak---- White oak----- American basswood--- Sugar maple----- White ash----- Black walnut----- Black cherry-----	65 --- 65 61 65 65 ---	Red pine, eastern white pine, white spruce.
61B----- Saylesville	2c	Slight	Slight	Slight	Slight	Northern red oak---- Sugar maple----- American basswood---	65 --- ---	Eastern white pine, red pine, white spruce.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	
62A----- Del Rey	3c	Slight	Slight	Severe	Severe	Northern red oak---- White ash----- Red maple----- White oak----- American basswood----	56 56 56 56 56	Northern red oak, northern white-cedar, white spruce, eastern white pine.
63----- Henrietta	3w	Slight	Severe	Severe	Severe	White ash----- Red maple----- Yellow birch----- American basswood---- Tamarack----- Northern white-cedar--- Swamp white oak----- Pin oak----- Green ash-----	56 56 54 56 49 --- --- --- ---	Northern white-cedar.
64B*, 64C*: Marlette-----	2o	Slight	Slight	Slight	Slight	Sugar maple----- Northern red oak----- White ash----- Black walnut----- American basswood----- Black cherry----- White oak-----	61 --- --- --- --- --- ---	White spruce, eastern white pine, black walnut.
Owosso-----	2o	Slight	Slight	Slight	Slight	Northern red oak---- Black cherry----- White ash----- Sugar maple----- American basswood----- White oak----- Yellow-poplar-----	65 --- 65 61 65 --- 65	Black walnut, white spruce, eastern white pine.
65A----- Capac	3o	Slight	Slight	Slight	Slight	Sugar maple----- Northern red oak----- American basswood----- Northern pin oak----- Shagbark hickory----- White ash----- Red maple----- Bitternut hickory----	56 56 56 --- --- 56 56 ---	Eastern white pine, white spruce, Norway spruce, northern white-cedar.
66E----- Eleva Variant	2r	Slight	Severe	Slight	Slight	Northern red oak----- Sugar maple----- Red maple----- Eastern cottonwood---	66 61 64 100	Eastern white pine, red pine, white spruce.
67B----- Whalan	2o	Slight	Slight	Slight	Slight	Eastern white pine-- Northern red oak----- White oak----- Black walnut-----	58 60 60 55	Eastern white pine.
68B*, 68C*: Oshtemo-----	2o	Slight	Slight	Slight	Slight	Northern red oak----- White oak----- American basswood----- Sugar maple-----	66 --- 66 61	Eastern white pine, red pine, white spruce.
Leon-----	2o	Slight	Slight	Slight	Slight	Northern red oak----- White oak----- American basswood----- Sugar maple----- White ash----- Black walnut----- Black cherry-----	65 --- 65 61 65 65 ---	Red pine, eastern white pine, white spruce, black walnut.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

[illegible]

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
18*: Colwood-----	---	Siberian crabapple, silky dogwood, Tatarian honeysuckle, Amur privet, arrowwood, hawthorn.	Northern white-cedar, white spruce.	Norway spruce, eastern white pine.	Carolina poplar.
20----- Houghton	Vanhoutte spirea	Silky dogwood, Amur privet, white spruce, redosier dogwood.	Northern white-cedar.	Norway spruce, eastern white pine.	Carolina poplar.
22----- Cohoctah	Vanhoutte spirea	Amur privet, silky dogwood, Amur honeysuckle, redosier dogwood.	Northern white-cedar, Siberian crabapple, white spruce.	Eastern white pine, Norway spruce, green ash.	Carolina poplar.
29A----- Kibbie	---	Silky dogwood, white spruce, blue spruce, American cranberrybush.	Northern white-cedar, eastern white pine.	Norway spruce-----	Carolina poplar.
30----- Edwards	---	Amur privet, redosier dogwood, silky dogwood.	Northern white-cedar, nannyberry viburnum.	Norway spruce-----	Carolina poplar.
35B*, 35C*, 35D*: Arkport-----	Vanhoutte spirea	Autumn-olive, Tatarian honeysuckle, Amur privet.	Northern white-cedar, white spruce.	Red pine, eastern white pine, Norway spruce.	Carolina poplar.
Okee-----	Vanhoutte spirea	Lilac-----	Austrian pine, Siberian crabapple.	Eastern white pine, red pine.	---
37----- Palms	Vanhoutte spirea	Silky dogwood, Tatarian honeysuckle, American cranberrybush, white spruce.	Tamarack, northern white-cedar.	Norway spruce, eastern white pine.	Carolina poplar.
39A*: Ypsi-----	---	Silky dogwood, Amur privet, Tatarian honeysuckle.	Eastern white pine, white spruce, northern white-cedar.	Norway spruce-----	Carolina poplar.
Wauseon-----	---	Redosier dogwood, silky dogwood.	Northern white-cedar, medium purple willow.	Eastern white pine, Norway spruce.	Carolina poplar, green ash.
40----- Lenawee	---	Silky dogwood, redosier dogwood.	Eastern white pine, white spruce.	Norway spruce-----	Green ash, Carolina poplar.
42A, 42B, 42C, 42D----- Riddles	---	Autumn-olive, Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce.	Norway spruce, red pine.	Carolina poplar.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
43A----- Dixboro	---	Lilac, Amur honeysuckle, Amur privet, silky dogwood.	Eastern white pine, northern white-cedar.	Norway spruce-----	Carolina poplar.
44B, 44C, 44D----- Leon1	---	Autumn-olive, Tatarian honeysuckle, lilac, silky dogwood.	Austrian pine, eastern redcedar, white spruce.	Eastern white pine, Norway spruce, red pine.	---
45. Martisco					
46----- Sebewa	---	Silky dogwood, Amur privet.	White spruce, northern white-cedar.	Norway spruce, eastern white pine.	Carolina poplar, green ash.
47*: Histosols. Aquents.					
48----- Napoleon	---	Silky dogwood, white spruce.	Northern white-cedar.	Eastern white pine, Norway spruce.	Carolina poplar.
49B*, 49C*, 49D*, 49E*: Hillsdale-----	---	Lilac, autumn-olive.	White spruce, red pine.	Eastern white pine	Carolina poplar.
Riddles-----	---	Autumn-olive-----	Northern white-cedar, white spruce.	Norway spruce, red pine.	Carolina poplar.
51*: Udorthents. Udipsamments.					
52*, 53*. Pits					
55B, 55C----- Eleva	Manyflower cotoneaster.	Siberian peashrub, lilac, Siberian crabapple, Tatarian honeysuckle.	Eastern redcedar, northern white-cedar.	Green ash, eastern white pine, Norway spruce.	Carolina poplar.
56D*: Riddles-----	---	Autumn-olive-----	Northern white-cedar, white-spruce.	Norway spruce, red pine.	Carolina poplar.
Leon1-----	---	Autumn-olive, Tatarian honeysuckle, whitebelle honeysuckle, lilac, white spruce, silky dogwood.	Austrian pine, eastern redcedar.	Eastern white pine, Norway spruce, red pine.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
57A*: Urban land.					
Barry-----	Vanhoutte spirea	Redosier dogwood, silky dogwood, Amur honeysuckle, Amur privet.	White spruce, northern white- cedar.	Norway spruce-----	Carolina poplar, green ash.
Brady-----	---	Silky dogwood, whitebelle honeysuckle, Tatarian honeysuckle.	White spruce, northern white- cedar, blue spruce.	Norway spruce, red pine, eastern white pine.	Carolina poplar, green ash.
58B*, 58C*: Urban land.					
Oshtemo-----	Vanhoutte spirea, silky dogwood.	Autumn-olive, Tatarian honeysuckle.	---	Eastern white pine, red pine.	Carolina poplar.
59B*, 59C*: Urban land.					
Riddles-----	---	Autumn-olive-----	Northern white- cedar, white spruce.	Norway spruce-----	Carolina poplar.
60*: Urban land. Udorthents.					
61B-----	---	Northern white- cedar, lilac, common ninebark, silky dogwood.	White spruce, Austrian pine.	Eastern white pine, red pine.	---
62A-----	Vanhoutte spirea	Tatarian honeysuckle, American cranberrybush, Amur privet, lilac, blue spruce.	White spruce-----	Eastern white pine, Norway spruce.	Green ash, Carolina poplar.
63-----	---	Silky dogwood, redosier dogwood.	Northern white- cedar, white spruce.	Eastern white pine.	Carolina poplar, green ash.
64B*, 64C*: Marlette-----	---	Autumn-olive, lilac, silky dogwood.	Austrian pine, white spruce.	Red pine, eastern white pine, Norway spruce.	Carolina poplar, green ash.
Owosso-----	Silky dogwood, Vanhoutte spirea.	Lilac, Tatarian honeysuckle, Amur privet.	White spruce, Austrian pine.	Eastern white pine, Norway spruce.	Carolina poplar, green ash.
65A-----	---	Silky dogwood, American cranberrybush.	White spruce, northern white- cedar.	Norway spruce, eastern white pine.	Carolina poplar, green ash.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
66E----- Eleva Variant	---	Lilac, autumn- olive, Amur honeysuckle.	Northern white- cedar, Siberian crabapple.	White ash, eastern white pine.	---
67B----- Whalan	---	Siberian crabapple, Tatarian honey- suckle, lilac.	Eastern redcedar, white spruce.	Green ash, eastern white pine, red pine.	---
68B*, 68C*: Oshtemo-----	Vanhoutte spirea, silky dogwood.	Autumn-olive, Tatarian honeysuckle.	White spruce, Austrian pine.	Eastern white pine, red pine.	Carolina poplar.
Leoni-----	---	Autumn-olive, Tatarian honeysuckle, whitebelle honeysuckle, lilac, silky dogwood.	Austrian pine, eastern redcedar, white spruce.	Eastern white pine, Norway spruce.	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
11B*: Boyer-----	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Moderate: droughty.
Oshtemo-----	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight-----	Moderate: small stones.
11C*: Boyer-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: droughty, slope.
Oshtemo-----	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight-----	Moderate: small stones, slope.
11D*: Boyer-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Oshtemo-----	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
11E*: Boyer-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Leon-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
13B*: Ormas-----	Slight-----	Slight-----	Moderate: slope.	Slight-----	Moderate: droughty.
Spinks-----	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
13C*: Ormas-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: droughty, slope.
Spinks-----	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope, too sandy.
13D*: Ormas-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Spinks-----	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
14B----- Spinks	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
14C----- Spinks	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope, too sandy.
14D----- Spinks	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
15A----- Teasdale	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
16A----- Brady	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
17----- Barry	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
18*: Gilford-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Colwood-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
20----- Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
22----- Cohoctah	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: floods, wetness.
29A----- Kibbie	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
30----- Edwards	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
35B*: Arkport-----	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: too sandy.
Okee-----	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
35C*: Arkport-----	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: slope, too sandy.
Okee-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
35D*: Arkport-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too sandy.	Severe: slope.
Okee-----	Severe:	Severe:	Severe:	Moderate:	Severe:

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
39A*: Yps1-----	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Wauseon-----	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
40----- Lenawee	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
42A----- Riddles	Slight-----	Slight-----	Moderate: small stones.	Slight-----	Slight.
42B----- Riddles	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Slight.
42C----- Riddles	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
42D----- Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
43A----- Dixboro	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
44B----- Leoni	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Moderate: large stones, droughty.
44C----- Leoni	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: large stones, droughty, slope.
44D----- Leoni	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
45----- Martisco	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
46----- Sebewa	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
47*: Histosols. Aquents.					
48----- Napoleon	Severe: ponding, excess humus, too acid.	Severe: ponding, excess humus, too acid.	Severe: excess humus, ponding, too acid.	Severe: ponding, excess humus.	Severe: too acid, ponding, excess humus.
49B*: Hillsdale-----	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Slight.
Riddles-----	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
49C*: Hillsdale-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
Riddles-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
49D*, 49E*: Hillsdale-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Riddles-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
51*: Udorthents. Udipsamments.					
52*, 53*. Pits					
55B----- Eleva	Slight-----	Slight-----	Moderate: depth to rock, slope, small stones.	Slight-----	Moderate: thin layer.
55C----- Eleva	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope, thin layer.
56D*: Riddles-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Leoni-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
57A*: Urban land.					
Barry-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Brady-----	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
58B*: Urban land.					
Oshtemo-----	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight-----	Moderate: small stones.
58C*: Urban land.					
Oshtemo-----	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight-----	Moderate: small stones, slope.
59B*: Urban land.					
Riddles-----	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
59C*: Urban land.					
Riddles-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
60*: Urban land. Udorthents.					
61B----- Saylesville	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
62A----- Del Rey	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
63----- Henrietta	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
64B*: Marlette-----	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Slight.
Owosso-----	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Slight-----	Slight.
64C*: Marlette-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
Owosso-----	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight-----	Moderate: slope.
65A----- Capac	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
66E----- Eleva Variant	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
67B----- Whalan	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, depth to rock, percs slowly.	Slight-----	Moderate: thin layer.
68B*: Oshtemo-----	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight-----	Moderate: small stones.
Leon1-----	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Moderate: large stones, droughty.
68C*: Oshtemo-----	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight-----	Moderate: small stones, slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
68C*: Leon1-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: large stones, droughty, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
11B*: Boyer-----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Oshtemo-----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
11C*: Boyer-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Oshtemo-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
11D*: Boyer-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Oshtemo-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
11E*: Boyer-----	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Leon1-----	Very poor.	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
13B*: Ormas-----	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Spinks-----	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
13C*, 13D*: Ormas-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Spinks-----	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
14B----- Spinks	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
14C, 14D----- Spinks	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
15A----- Teasdale	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
16A----- Brady	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
17----- Barry	Good	Good	---	Fair	Fair	---	---	Good	Fair	---
18*: Gilford-----	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Colwood-----	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
20----- Houghton	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
22----- Cohoctah	Poor	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
29A----- Kibbie	Good	Good	Good	Good	Fair	Fair	Fair	Good	Good	Fair.
30----- Edwards	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
35B*: Arkport-----	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Okee-----	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
35C*: Arkport-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Okee-----	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
35D*: Arkport-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Okee-----	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
37----- Palms	Good	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Poor.
39A*: Ypsi-----	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Wauseon-----	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
40----- Lenawee	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
42A, 42B----- Riddles	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
42C----- Riddles	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
42D----- Riddles	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
43A----- Dixboro	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
44B----- Leon1	Poor	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
44C----- Leon1	Poor	Good	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
44D----- Leon1	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
45----- Martisco	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
46----- Sebewa	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
47*: Histosols. Aquents.										
48----- Napoleon	Very poor.	Very poor.	Poor	Poor	Poor	Good	Good	Very poor.	Poor	Good.
49B*: Hillsdale-----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Riddles-----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
49C*: Hillsdale-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Riddles-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
49D*: Hillsdale-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Riddles-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
49E*: Hillsdale-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Riddles-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
51*: Udorthents. Udipsamments.										
52*, 53*. Fits										
55B, 55C----- Eleva	Good	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
56D*: Riddles-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Leoni-----	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
57A*: Urban land.										
Barry-----	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Brady-----	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
58B*: Urban land.										
Oshtemo-----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
58C*: Urban land.										
Oshtemo-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
59B*: Urban land.										
Riddles-----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
59C*: Urban land.										
Riddles-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
60*: Urban land.										
Udorthents.										
61B----- Saylesville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
62A----- Del Rey	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
63----- Henrietta	Fair	Good	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
64B*: Marlette-----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Owosso-----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
64C*: Marlette-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Owosso-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
65A----- Capac	Good	Good	Good	Good	Fair	Fair	Fair	Good	Good	Fair.
66E----- Eleva Variant	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
67B----- Whalan	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
68B*: Oshtemo-----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
68B*: Leon1-----	Poor	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
68C*: Oshtemo-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Leon1-----	Poor	Good	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

[illegible]

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
14C----- Spinks	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
14D----- Spinks	Severe: cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope, too sandy.
15A----- Teasdale	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
16A----- Brady	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
17----- Barry	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
18*: Gilford-----	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Colwood-----	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
20----- Houghton	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
22----- Cohoctah	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action, wetness.	Severe: floods, wetness.
29A----- Kibbie	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
30----- Edwards	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action, low strength.	Severe: excess humus, ponding.
35B*: Arkport-----	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Moderate: low strength.	Moderate: too sandy.
Okee-----	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
350*: Arkport-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, low strength.	Moderate: slope, too sandy.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
35D*: Okee-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
37----- Palms	Severe: excess humus, ponding.	Severe: ponding, low strength, floods.	Severe: ponding, low strength, floods.	Severe: ponding, floods, low strength.	Severe: ponding, floods, frost action.	Severe: ponding, floods, excess humus.
39A*: Ypsi-----	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
Wauseon-----	Severe: ponding, cutbanks cave.	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
40----- Lenawee	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
42A----- Riddles	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.	Slight.
42B----- Riddles	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, frost action.	Slight.
42C----- Riddles	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
42D----- Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
43A----- Dixboro	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
44B----- Leon1	Severe: cutbanks cave.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, slope, large stones.	Moderate: shrink-swell, large stones.	Moderate: large stones, droughty.
44C----- Leon1	Severe: cutbanks cave.	Moderate: shrink-swell, slope, large stones.	Moderate: slope, shrink-swell, large stones.	Severe: slope.	Moderate: slope, shrink-swell, large stones.	Moderate: large stones, droughty, slope.
44D----- Leon1	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
45----- Martisco	Severe: ponding, excess humus.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
46----- Sebewa	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: frost action.	Severe: ponding.
47*: Histosols.						

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
47*: Aquents.						
48----- Napoleon	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: too acid, ponding, excess humus.
49B*: Hillsdale-----	Slight-----	Slight-----	Slight-----	Moderate: slope.	Moderate: frost action.	Slight.
Riddles-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, frost action.	Slight.
49C*: Hillsdale-----	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Riddles-----	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
49D*, 49E*: Hillsdale-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Riddles-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
51*: Udorthents. Udipsamments.						
52*, 53*. Pits						
55B----- Eleva	Moderate: depth to rock.	Slight-----	Moderate: depth to rock.	Moderate: slope.	Moderate: frost action.	Moderate: thin layer.
55C----- Eleva	Moderate: slope, depth to rock.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, thin layer.
56D*: Riddles-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Leoni-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
57A*: Urban land.						
Barry-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Brady-----	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
58B*: Urban land.						

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
58B*: Oshtemo-----	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: small stones.
58C*: Urban land. Oshtemo-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, slope.
59B*: Urban land. Riddles-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.	Slight.
59C*: Urban land. Riddles-----	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
60*: Urban land. Udorthents.						
61B----- Saylesville	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: shrink-swell, wetness.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
62A----- Del Rey	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
63----- Henrietta	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
64B*: Marlette-----	Slight-----	Slight-----	Slight-----	Moderate: slope.	Severe: low strength.	Slight.
Owosso-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.	Slight.
64C*: Marlette-----	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
Owosso-----	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
65A----- Capac	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength.	Moderate: wetness.
66E----- Eleva Variant	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
67B----- Whalan	Moderate: depth to rock, too clayey.	Slight-----	Moderate: depth to rock.	Slight-----	Severe: low strength.	Moderate: thin layer.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
68B*: Oshtemo-----	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Slight-----	Moderate: small stones.
Leoni-----	Severe: cutbanks cave.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, slope, large stones.	Moderate: shrink-swell, large stones.	Moderate: large stones, droughty.
68C*: Oshtemo-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, slope.
Leoni-----	Severe: cutbanks cave.	Moderate: shrink-swell, slope, large stones.	Moderate: slope, shrink-swell, large stones.	Severe: slope.	Moderate: slope, shrink-swell, large stones.	Moderate: large stones, droughty, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
11B*: Boyer-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Oshtemo-----	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
11C*: Boyer-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Oshtemo-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage.
11D*: Boyer-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Oshtemo-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, slope.
11E*: Boyer-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Leon-----	Severe: slope.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: large stones, slope.
13B*: Ormas-----	Slight-----	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
Spinks-----	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
13C*: Ormas-----	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
13D*: Spinks-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
14B----- Spinks	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
14C----- Spinks	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
14D----- Spinks	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
15A----- Teasdale	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
16A----- Brady	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
17----- Barry	Severe: ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: ponding.
18*: Gilford-----	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Colwood-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding, thin layer.
20----- Houghton	Severe: ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
22----- Cohoctah	Severe: wetness, floods.	Severe: floods, seepage, wetness.	Severe: seepage, floods, wetness.	Severe: seepage, floods, wetness.	Poor: wetness.
29A----- Kibbie	Severe: wetness.	Severe: wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: too sandy, wetness.
30----- Edwards	Severe: ponding, percs slowly.	Severe: ponding, seepage, excess humus.	Severe: ponding.	Severe: ponding, seepage.	Poor: ponding, excess humus.
35B*: Arkport-----	Slight-----	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
Okee-----	Slight-----	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

[illegible]

TABLE 12.--SANITARY FACILITIES--Continued

[illegible]

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
56D*: Riddles-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Leon-----	Severe: slope.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: large stones, slope.
57A*: Urban land.					
Barry-----	Severe: ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: ponding.
Brady-----	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
58B*: Urban land.					
Oshtemo-----	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
58C*: Urban land.					
Oshtemo-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage.
59B*: Urban land.					
Riddles-----	Slight-----	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.
59C*: Urban land.					
Riddles-----	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
60*: Urban land.					
Udorthents.					
61B----- Saylesville	Severe: percs slowly, wetness.	Moderate: slope.	Moderate: too clayey, wetness.	Slight-----	Fair: too clayey.
62A----- Del Rey	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
63----- Henrietta	Severe: ponding.	Severe: excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
64B*: Marlette-----	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
64B*: Owosso-----	Severe: percs slowly.	Moderate: slope.	Slight-----	Severe: seepage.	Good.
64C*: Marlette-----	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
Owosso-----	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Severe: seepage.	Fair: slope.
65A----- Capac	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
66E----- Eleva Variant	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, seepage, small stones.
67B----- Whalan	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
68B*: Oshtemo-----	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
Leon1-----	Slight-----	Severe: seepage, large stones.	Severe: seepage, large stones.	Severe: seepage.	Poor: large stones.
68C*: Oshtemo-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage.
Leon1-----	Moderate: slope.	Severe: seepage, slope, large stones.	Severe: seepage, large stones.	Severe: seepage.	Poor: large stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
11B*, 11C*: Boyer-----	Good-----	Probable-----	Probable-----	Poor: small stones, area reclaim.
Oshtemo-----	Good-----	Probable-----	Probable-----	Poor: small stones.
11D*: Boyer-----	Fair: slope.	Probable-----	Probable-----	Poor: small stones, area reclaim, slope.
Oshtemo-----	Fair: slope.	Probable-----	Probable-----	Poor: small stones, slope.
11E*: Boyer-----	Poor: slope.	Probable-----	Probable-----	Poor: small stones, area reclaim, slope.
Leoni-----	Poor: slope.	Improbable: large stones.	Improbable: large stones.	Poor: large stones, area reclaim, slope.
13B*: Ormas-----	Good-----	Probable-----	Probable-----	Fair: too sandy, small stones.
Spinks-----	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy.
13C*: Ormas-----	Good-----	Probable-----	Probable-----	Fair: too sandy, small stones.
Spinks-----	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy.
13D*: Ormas-----	Fair: slope.	Probable-----	Probable-----	Poor: slope.
Spinks-----	Fair: slope.	Probable-----	Improbable: too sandy.	Poor: slope, too sandy.
14B, 14C-----	Good-----	Probable-----	Improbable-----	Poor-----

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
16A----- Brady	Fair: wetness.	Probable-----	Probable-----	Poor: small stones.
17----- Barry	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, wetness.
18*: Gilford-----	Poor: wetness.	Probable-----	Improbable: too sandy.	Poor: wetness.
Colwood-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
20----- Houghton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
22----- Cohoctah	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
29A----- Kibbie	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
30----- Edwards	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
35B*, 35C*: Arkport-----	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Okee-----	Good-----	Probable-----	Probable-----	Poor: area reclaim.
35D*: Arkport-----	Fair: slope, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too sandy.
Okee-----	Fair: slope.	Probable-----	Probable-----	Poor: area reclaim, slope.
37----- Palms	Poor: wetness.	Improbable: excess humus, excess fines.	Improbable: excess humus, excess fines.	Poor: wetness, excess humus.
39A*: Ypsi-----	Fair: thin layer, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Wauseon-----	Poor: wetness, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
40----- Lenawee	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
42A, 42B----- Riddles	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
42C----- Riddles	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
42D----- Riddles	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
43A----- Dixboro	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
44B, 44C----- Leoni	Fair: large stones.	Improbable: large stones.	Improbable: large stones.	Poor: large stones, area reclaim.
44D----- Leoni	Fair: large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: large stones, area reclaim, slope.
45----- Martisco	Poor: wetness, excess humus.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
46----- Sebewa	Poor: wetness.	Probable-----	Probable-----	Poor: wetness, small stones, area reclaim.
47*: Histosols. Aquents.				
48----- Napoleon	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness, too acid.
49B*: Hillsdale-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Riddles-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
49C*: Hillsdale-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Riddles-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
49D*, 49E*: Hillsdale-----	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Riddles-----	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
51*: Udorthents. Udipsamments.				
52*, 53*. Pits				
55B----- Eleva	Poor: area reclaim.	Improbable: thin layer.	Improbable: excess fines.	Fair: area reclaim, small stones.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
55C----- Eleva	Poor: area reclaim.	Improbable: thin layer.	Improbable: excess fines.	Fair: slope, area reclaim, small stones.
56D*: Riddles-----	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Leon1-----	Fair: large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: large stones, area reclaim, slope.
57A*: Urban land.				
Barry-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, wetness.
Brady-----	Fair: wetness.	Probable-----	Probable-----	Poor: small stones.
58B*, 58C*: Urban land.				
Oshtemo-----	Good-----	Probable-----	Probable-----	Poor: small stones.
59B*: Urban land.				
Riddles-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
59C*: Urban land.				
Riddles-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
60*: Urban land.				
Udorthents.				
61B----- Saylesville	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
62A----- Del Rey	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
63----- Henrietta	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
64B*: Marlette-----	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Owosso-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
64C*: Marlette-----	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
Owosso-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
65A----- Capac	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
66E----- Eleva Variant	Poor: area reclaim.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, slope.
67B----- Whalan	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim,

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
11B*: Boyer-----	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, soil blowing.	Droughty.
Oshtemo-----	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Favorable.
11C*, 11D*: Boyer-----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, soil blowing.	Slope, droughty.
Oshtemo-----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope.
11E*: Boyer-----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, soil blowing.	Slope, droughty.
Leoni-----	Severe: seepage, slope.	Severe: large stones.	Severe: no water.	Deep to water	Large stones, droughty, slope.	Large stones, slope, droughty.
13B*: Ormas-----	Severe: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Droughty.
Spinks-----	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Droughty.
13C*, 13D*: Ormas-----	Severe: seepage, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, droughty.
Spinks-----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, droughty.
14B----- Spinks	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Droughty.
14C, 14D----- Spinks	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, droughty.
15A----- Teasdale	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action---	Wetness, soil blowing.	Wetness.
16A----- Brady	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action---	Wetness, soil blowing.	Wetness.
17----- Barry	Severe: seepage.	Severe: piping, ponding.	Moderate: slow refill.	Ponding, frost action.	Ponding-----	Wetness.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
18*: Gilford-----	Severe: seepage.	Severe: seepage, ponding.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, droughty.	Wetness, droughty.
Colwood-----	Moderate: seepage.	Severe: piping, ponding.	Severe: cutbanks cave.	Ponding, frost action.	Ponding-----	Wetness, erodes easily.
20----- Houghton	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Frost action, subsides, ponding.	Soil blowing, ponding.	Wetness.
22----- Cohoctah	Severe: seepage.	Severe: piping, wetness.	Slight-----	Floods, frost action.	Wetness, soil blowing.	Wetness.
29A----- Kibbie	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness-----	Wetness, erodes easily.
30----- Edwards	Severe: seepage.	Severe: ponding.	Severe: slow refill.	Frost action, ponding, subsides.	Ponding, soil blowing.	Wetness.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
43A----- Dixboro	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness-----	Wetness.
44B----- Leoni	Severe: seepage.	Severe: large stones.	Severe: no water.	Deep to water	Large stones, droughty, slope.	Large stones, droughty.
44C, 44D----- Leoni	Severe: seepage, slope.	Severe: large stones.	Severe: no water.	Deep to water	Large stones, droughty, slope.	Large stones, slope, droughty.
45----- Martisco	Severe: seepage.	Severe: wetness.	Severe: slow refill.	Percs slowly, poor outlets, wetness.	Wetness-----	Not needed.
46----- Sebewa	Severe: seepage.	Severe: seepage, ponding.	Moderate: slow refill, cutbanks cave.	Frost action, cutbanks cave, ponding.	Ponding-----	Wetness.
47*: Histosols. Aquents.						
48----- Napoleon	Severe: seepage.	Severe: excess humus, wetness.	Moderate: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing, too acid.	Wetness.
49B*: Hillsdale-----	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing---	Favorable.
Riddles-----	Moderate: seepage, slope.	Slight-----	Severe: no water.	Deep to water	Slope, soil blowing.	Favorable.
49C*, 49D*, 49E*: Hillsdale-----	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing---	Slope.
Riddles-----	Severe: slope.	Slight-----	Severe: no water.	Deep to water	Slope, soil blowing.	Slope.
51*: Udorthents. Udipsamments.						
52*, 53*. Pits						
55B----- Eleva	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing, depth to rock, slope.	Depth to rock.
55C----- Eleva	Severe: slope, seepage.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing, depth to rock, slope.	Slope, depth to rock.
56D*: Riddles-----	Severe: slope.	Slight-----	Severe: no water.	Deep to water	Slope, soil blowing.	Slope.
Leoni-----	Severe: seepage, slope.	Severe: large stones.	Severe: no water.	Deep to water	Large stones, droughty, slope.	Large stones, slope, droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
57A*: Urban land.						
Barry-----	Severe: seepage.	Severe: piping, ponding.	Moderate: slow refill.	Ponding, frost action.	Ponding-----	Wetness.
Brady-----	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action---	Wetness, soil blowing.	Wetness.
58B*: Urban land.						
Oshtemo-----	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Favorable.
58C*: Urban land.						
Oshtemo-----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope.
59B*: Urban land.						
Riddles-----	Moderate: seepage, slope.	Slight-----	Severe: no water.	Deep to water	Slope, soil blowing.	Favorable.
59C*: Urban land.						
Riddles-----	Severe: slope.	Slight-----	Severe: no water.	Deep to water	Slope, soil blowing.	Slope.
60*: Urban land.						
Udorthents.						
61B-----	Moderate: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Erodes easily.
62A-----	Slight-----	Severe: wetness.	Severe: slow refill.	Peres slowly, frost action.	Wetness, peres slowly.	Wetness, erodes easily, peres slowly.
63-----	Moderate: seepage.	Severe: piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, soil blowing.	Wetness.
64B*: Marlette-----	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope-----	Favorable.
Owosso-----	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Erodes easily.
64C*: Marlette-----	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope-----	Slope.
Owosso-----	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope, erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
65A----- Capac	Moderate: seepage.	Severe: piping.	Severe: slow refill.	Frost action---	Wetness-----	Wetness.
		wetness.				
66E----- Eleva Variant	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Droughty, depth to rock, slope.	Large stones, slope, droughty.
67B----- Whalan	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Percs slowly, depth to rock, slope.	Depth to rock, percs slowly.
68B*: Oshtemo-----	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Favorable.
Leoni-----	Severe: seepage.	Severe: large stones.	Severe: no water.	Deep to water	Large stones, droughty, slope.	Large stones, droughty.
68C*: Oshtemo-----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope.
Leoni-----	Severe: seepage, slope.	Severe: large stones.	Severe: no water.	Deep to water	Large stones, droughty, slope.	Large stones, slope, droughty.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
11B*, 11C*, 11D*: Boyer-----	0-11	Sandy loam-----	SM, SM-SC	A-2, A-4	0-5	95-100	75-95	60-75	25-40	<25	NP-7
	11-34	Sandy loam, loam, gravelly sandy loam.	SM, SC, SM-SC, SP-SM	A-2, A-4, A-6	0-5	80-100	65-95	55-85	10-45	10-35	NP-16
	34-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-10	40-100	35-100	30-70	0-10	---	NP
Oshtemo-----	0-17	Sandy loam-----	SM, SM-SC	A-2, A-4	0	95-100	60-95	60-70	25-40	15-25	2-7
	17-28	Gravelly sandy loam, gravelly sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	95-100	60-95	60-85	25-45	12-30	2-16
	28-60	Stratified coarse sand to gravel.	SP-SM, GP, SP, GP-GM	A-1, A-2, A-3	0-5	40-90	35-85	20-60	0-10	---	NP
11E*: Boyer-----	0-11	Sandy loam-----	SM, SM-SC	A-2, A-4	0-5	95-100	75-95	60-75	25-40	<25	NP-7
	11-34	Sandy loam, loam, gravelly sandy loam.	SM, SC, SM-SC, SP-SM	A-2, A-4, A-6	0-5	80-100	65-95	55-85	10-45	10-35	NP-16
	34-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-10	40-100	35-100	30-70	0-10	---	NP
Leoni-----	0-13	Gravelly sandy loam.	SM	A-2, A-4	1-20	85-95	75-90	60-80	30-50	<30	NP-7
	13-29	Cobbly clay loam, gravelly sandy clay loam, gravelly sandy loam.	CL, SC, GC	A-6, A-4	10-50	70-85	60-85	50-70	40-60	25-40	8-20
	29-42	Gravelly sandy loam, cobbly sandy clay loam, gravelly clay loam.	SM, SC, SM-SC, SP-SM	A-2, A-1	10-50	70-85	60-85	40-50	10-25	<25	NP-8
	42-60	Cobbly sand, very gravelly loamy sand, very gravelly sandy loam.	SM, SP-SM, SC, SM-SC	A-1, A-2, A-4	5-60	65-85	40-80	35-50	5-40	<22	NP-8
13B*, 13C*, 13D*: Ormas-----	0-21	Loamy sand-----	SM	A-2-4	0	98-100	95-100	50-75	15-30	---	NP
	21-26	Sandy loam-----	SM-SC, SM	A-2-4, A-4	0	90-100	85-100	50-70	25-40	<15	NP-5
	26-45	Sandy clay loam, gravelly sandy loam, loamy sand.	SM-SC, SC, GC, GM-GC	A-4, A-6, A-2-4, A-2-6	0	60-80	55-80	35-70	20-45	20-40	6-20
	45-60	Gravelly sand----	SP, SP-SM	A-3, A-1-B, A-2-4	0	60-80	55-80	30-55	3-12	---	NP
Spinks-----	0-18	Sand-----	SP-SM, SM	A-2-4, A-3	0	100	80-100	50-90	5-20	---	NP
	18-29	Sand-----	SM	A-2-4	0	100	80-100	50-90	15-25	---	NP
	29-68	Stratified fine sand to sand.	SM, SP-SM	A-2-4	0	100	80-100	60-90	10-30	---	NP
14B, 14C, 14D---- Spinks	0-18	Sand-----	SP-SM, SM	A-2-4, A-3	0	100	80-100	50-90	5-20	---	NP
	18-29	Sand-----	SM	A-2-4	0	100	80-100	50-90	15-25	---	NP
	29-68	Stratified fine sand to sand.	SM, SP-SM	A-2-4	0	100	80-100	60-90	10-30	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
15A----- Teasdale	0-13	Fine sandy loam	SM, SM-SC, SC	A-2-4, A-4	0-5	95-100	95-100	55-95	25-50	<25	2-8
	13-55	Sandy loam, fine sandy loam, gravelly sandy clay loam.	ML, CL, SM, SC	A-2-4, A-2-6, A-4, A-6	0-8	85-100	80-100	50-85	25-70	20-35	2-15
	55-65	Sandy loam, loamy sand, fine sandy loam.	SM, SM-SC, SC	A-2-4, A-4	0-5	85-100	85-100	55-70	15-40	<25	NP-8
16A----- Brady	0-13	Sandy loam-----	SM, SM-SC	A-2, A-4	0-5	95-100	75-100	60-70	25-40	<25	NP-7
	13-30	Sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0-5	95-100	75-95	60-80	25-45	15-35	NP-16
	30-54	Loamy sand, sandy loam.	SM	A-2	0-5	95-100	75-95	55-70	15-35	---	NP
	54-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-5	40-75	35-70	20-55	0-10	---	NP
17----- Barry	0-10	Loam-----	ML, CL, CL-ML	A-4	0-3	95-100	90-100	80-100	55-90	20-30	NP-8
	10-26	Loam, sandy clay loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0-3	95-100	90-100	80-90	45-75	18-28	4-14
	26-60	Sandy loam, loamy sand.	SM, SM-SC	A-2, A-4	0-3	95-100	90-100	35-70	30-40	<20	NP-5
18*: Gilford-----	0-15	Fine sandy loam	SM, SC, SM-SC	A-4	0	95-100	90-100	65-80	35-45	15-25	2-10
	15-35	Loam, fine sandy loam, loamy sand	SM, SC, SM-SC	A-2-4	0	90-100	90-100	55-70	25-35	20-30	NP-8
	35-60	Sandy loam, sand, loamy sand.	SM, SP, SP-SM	A-3, A-1-B,	0	90-100	85-100	18-60	3-18	---	NP
Colwood-----	0-16	Silt loam, very fine sandy loam.	ML	A-4, A-6	0	100	100	85-100	60-90	30-40	2-12
	16-33	Stratified loamy fine sand to clay loam.	CL, CL-ML	A-6, A-4	0	100	100	80-100	50-90	20-40	6-20
	33-60	Stratified silt loam to fine sand.	SM, ML	A-2, A-4	0	100	95-100	70-100	30-80	<35	NP-10
20----- Houghton	0-60	Sapric material	Pt	A-8	0	---	---	---	---	---	---
22----- Cohoctah	0-11	Fine sandy loam	ML, SM	A-4, A-2	0	100	100	65-95	30-75	<30	NP-6
	11-40	Loam, fine sandy loam, very fine sandy loam.	ML, SM, SC, CL	A-4, A-2	0	95-100	80-100	70-90	30-70	<30	NP-10
	40-60	Silt loam, sand--	ML, SM, SC, CL	A-4, A-2	0	95-100	80-100	65-90	20-70	<30	NP-10
29A----- Kibble	0-9	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	100	100	75-95	40-60	18-25	2-7
	9-27	Silt loam, clay loam, fine sandy loam.	CL, CL-ML, SC, SM-SC	A-4, A-6, A-7	0	90-100	85-100	80-100	35-90	25-45	6-25
	27-60	Stratified silt loam to fine sand.	ML, SM, SC, CL	A-4, A-2	0	100	95-100	70-95	30-80	<30	NP-10
30----- Edwards	0-28	Sapric material	Pt	A-8	0	---	---	---	---	---	---
	28-60	Marl-----	---	---	0	100	95-100	80-90	60-80	---	---

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
35B*, 35C*, 35D*: Arkport-----	0-8	Loamy fine sand	SM	A-2, A-4	0	90-100	90-100	65-85	20-45	---	NP
	8-21	Very fine sandy loam, loamy very fine sand, loamy fine sand.	SM, ML	A-2, A-4	0	90-100	90-100	70-95	30-65	<15	NP-4
	21-62	Fine sandy loam, loamy fine sand, loamy very fine sand.	SM, ML	A-2, A-4	0	90-100	90-100	65-95	20-60	---	NP
	62-66	Loamy fine sand, fine sand, very fine sand.	SM	A-2, A-4	0	90-100	90-100	60-95	15-50	---	NP
Okee-----	0-24	Loamy fine sand	SM, SP-SM	A-2, A-4, A-1-B	0	90-100	90-100	45-85	10-40	---	NP
	24-52	Sandy clay loam, sandy loam.	SC, SM, ML, CL	A-2, A-4	0-10	90-100	90-100	50-90	20-55	<25	2-10
	52-58	Sandy loam, loamy sand.	SM, SP-SM	A-2, A-4, A-1-B	0-10	85-100	85-100	40-75	10-40	<15	NP-3
	58-66	Gravelly sandy loam, sandy loam, loamy	SM, SP-SM, GM, GP-GM	A-2, A-4, A-3, A-1-B	1-15	50-95	50-95	25-75	5-40	---	NP
37----- Palms	0-32	Sapric material	Pt	---	---	---	---	---	---	---	---
	32-60	Clay loam, sandy loam, loamy sand	ML, CL, SM, SC	A-4, A-6 A-2	0	85-100	80-100	70-95	25-90	15-40	NP-20
39A*: Yps1-----	0-8	Sandy loam-----	SM, SM-SC	A-2, A-4	0-5	95-100	90-100	60-75	20-45	<25	NP-7
	8-29	Sandy loam, loamy sand, gravelly sandy loam.	SM, SC, SM-SC	A-2, A-4	0-5	95-100	80-100	60-75	20-40	15-30	2-10
	29-60	Silty clay, clay, silty clay loam.	CH, CL	A-7	0-5	95-100	85-100	85-95	80-95	41-60	20-35
Wauseon-----	0-13	Loam-----	ML	A-4	0	100	95-100	80-95	60-75	<35	NP-10
	13-36	Sandy loam, loamy fine sand, gravelly sandy loam.	SM	A-2, A-4	0	100	80-100	70-95	20-45	---	NP
	36-60	Clay, silty clay, silty clay loam.	CH, CL, MH, ML	A-7	0	100	95-100	90-100	80-95	42-70	18-36
40----- Lenawee	0-9	Silt loam-----	CL-ML, CL	A-4, A-6	0	100	95-100	95-100	65-85	20-35	5-14
	9-38	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	95-100	90-100	80-95	25-55	11-30
	38-60	Silt loam, silty clay loam, very fine sand.	CL, CL-ML	A-6, A-4, A-7	0	100	95-100	95-100	85-95	25-45	6-22
42A, 42B, 42C, 42D----- Riddles	0-13	Sandy loam-----	SM, SC, SM-SC	A-2-4, A-4	0	95-100	85-95	50-70	25-40	20-30	2-10
	13-19	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	90-100	80-95	75-90	35-75	25-40	10-20
	19-44	Clay loam, sandy clay loam.	CL	A-6, A-7	0	90-100	80-95	75-95	65-75	35-50	15-30
	44-60	Clay loam, sandy loam, loam.	CL, SM, SC, ML	A-4, A-6, A-2	0-3	85-95	80-90	50-90	30-70	15-30	2-15
43A----- Dixboro	0-17	Very fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4	0	100	100	70-95	40-65	<20	2-6

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	<u>In</u>				<u>Pct</u>					<u>Pct</u>	
44B, 44C, 44D---- Leoni	0-13	Gravelly sandy loam.	SM	A-2, A-4	1-20	85-95	75-90	60-80	30-50	<30	NP-7
	13-29	Cobbly clay loam, gravelly sandy clay loam, gravelly sandy loam.	CL, SC, GC	A-6, A-4	10-50	70-85	60-85	50-70	40-60	25-40	8-20
	29-42	Gravelly sandy loam, cobbly sandy clay loam, gravelly clay loam.	SM, SC, SM-SC, SP-SM	A-2, A-1	10-50	70-85	60-85	40-50	10-25	<25	NP-8
	42-60	Cobbly sand, very gravelly loamy sand, cobbly sandy loam.	SM, SP-SM, SC, SM-SC	A-1, A-2, A-4	5-60	65-85	40-80	35-50	5-40	<22	NP-8
45----- Martisco	0-8	Sapric material--	Pt	---	0	---	---	---	---	---	---
	8-60	Marl-----	---	---	0	---	---	---	---	---	---
46----- Sebewa	0-15	Loam-----	CL, CL-ML	A-4, A-6	0	95-100	80-100	75-95	50-90	22-35	6-12
	15-35	Clay loam, loam, gravelly clay loam.	SC, CL	A-4, A-6	0	95-100	65-95	55-85	40-75	25-40	8-20
	35-60	Sand and gravel	SP, SP-SM, GP, GP-GM	A-1	0-5	40-75	35-70	20-40	0-10	---	NP
47*: Histosols. Aquents.											
48----- Napoleon	0-10	Sapric material	Pt	A-8	0	---	---	---	---	---	---
	10-60	Hemic material---	Pt	A-8	0	---	---	---	---	---	---
49B*, 49C*, 49D*, 49E*: Hillsdale----- Riddles-----	0-10	Sandy loam-----	SM, SC, ML, CL	A-2-4, A-4	0-5	95-100	85-100	60-90	20-65	15-30	2-10
	10-15	Sandy loam-----	SM, SM-SC, SC	A-2-4, A-4	0-5	95-100	85-100	60-85	15-50	15-30	2-10
	15-63	Sandy loam, sandy clay loam, loam.	SM, SC, SM-SC	A-2-4, A-2-6, A-4, A-6	0-5	95-100	85-100	65-85	30-50	12-38	2-19
	63-66	Sandy loam, loamy sand.	SM, SC, SM-SC	A-2-4, A-4	0-5	95-100	85-100	55-80	25-40	15-22	3-8
	0-13	Sandy loam-----	SM, SC, SM-SC	A-2-4, A-4	0	95-100	85-95	50-70	25-40	20-30	2-10
	13-19	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	90-100	80-95	75-90	35-75	25-40	10-20
	19-44	Clay loam, sandy clay loam.	CL	A-6, A-7	0	90-100	80-95	75-95	65-75	35-50	15-30
	44-60	Clay loam, sandy loam, loam.	CL, SM, SC, ML	A-4, A-6, A-2	0-3	85-95	80-90	50-90	30-70	15-30	2-15
	51*: Udorthents. Udipsamments.										
52*, 53*. Pits											
55B, 55C----- Eleva	0-16	Sandy loam-----	SM, SM-SC	A-2, A-4	0	95-100	80-100	50-90	25-50	<20	2-7
	16-29	Loam, sandy loam, fine sandy loam.	ML, CL-ML, SM, SM-SC	A-2, A-4	0	95-100	80-100	50-95	25-65	<25	NP-7
	29-45	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth In	USDA texture	Classification		Frag- ments > 3 inches Pct	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
56D*: Riddles-----	0-13	Sandy loam-----	SM, SC, SM-SC	A-2-4, A-4	0	95-100	85-95	50-70	25-40	20-30	2-10
	13-19	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	90-100	80-95	75-90	35-75	25-40	10-20
	19-44	Clay loam, sandy clay loam.	CL	A-6, A-7	0	90-100	80-95	75-95	65-75	35-50	15-30
	44-60	Clay loam, sandy loam, loam.	CL, SM, SC, ML	A-4, A-6, A-2	0-3	85-95	80-90	50-90	30-70	15-30	2-15
Leoni-----	0-13	Gravelly sandy loam.	SM	A-2, A-4	1-20	85-95	75-90	60-80	30-50	<30	NP-7
	13-29	Cobbly clay loam, gravelly sandy clay loam, gravelly sandy loam.	CL, SC, GC	A-6, A-4	10-50	70-85	60-85	50-70	40-60	25-40	8-20
	29-42	Cobbly sandy loam, cobbly sandy clay loam, gravelly clay loam.	SM, SC, SM-SC, SP-SM	A-2, A-1	10-50	70-85	60-85	40-50	10-25	<25	NP-8
	42-60	Cobbly sand, very gravelly loamy sand, very gravelly sandy loam.	SM, SP-SM, SC, SM-SC	A-1, A-2, A-4	5-60	65-85	40-80	35-50	5-40	<22	NP-8
57A*: Urban land.											
Barry-----	0-10	Loam-----	ML, CL, CL-ML	A-4	0-3	95-100	90-100	80-100	55-90	20-30	NP-8
	10-26	Loam, sandy clay loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0-3	95-100	90-100	80-90	45-75	18-28	4-14
	26-60	Sandy loam, loamy sand.	SM, SM-SC	A-2, A-4	0-3	95-100	90-100	35-70	30-40	<20	NP-5
Brady-----	0-13	Sandy loam-----	SM, SM-SC	A-2, A-4	0-5	95-100	75-100	60-70	25-40	<25	NP-7
	13-30	Sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0-5	95-100	75-95	60-80	25-45	15-35	NP-16
	30-54	Loamy sand, sandy loam.	SM	A-2	0-5	95-100	75-95	55-70	15-35	---	NP
	54-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-5	40-75	35-70	20-55	0-10	---	NP
58B*, 58C*: Urban land.											
Oshtemo-----	0-17	Sandy loam-----	SM, SM-SC	A-2, A-4	0	95-100	60-95	60-70	25-40	15-25	2-7
	17-28	Gravelly sandy loam, gravelly sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	95-100	60-95	60-85	25-45	12-30	2-16
	28-50	Sand-----	SM, SP-SM	A-2	0	85-95	60-95	55-70	10-15	---	NP
	50-60	Stratified coarse sand to gravel.	SP-SM, GP, SP, GP-GM	A-1, A-2, A-3	0-5	40-90	35-85	20-60	0-10	---	NP
59B*, 59C*: Urban land.											
Riddles-----	0-13	Sandy loam-----	SM, SC, SM-SC	A-2-4, A-4	0	95-100	85-95	50-70	25-40	20-30	2-10
	13-19	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	90-100	80-95	75-90	35-75	25-40	10-20
	19-44	Clay loam, sandy clay loam.	CL	A-6, A-7	0	90-100	80-95	75-95	65-75	35-50	15-30
	44-60	Clay loam, sandy loam, loam.	CL, SM, SC, ML	A-4, A-6, A-2	0-3	85-95	80-90	50-90	30-70	15-30	2-15

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
60*: Urban land. Udorthents.											
61B----- Saylesville	0-10	Silt loam-----	ML, CL, CL-ML	A-4	0	100	95-100	85-100	60-90	20-30	3-10
	10-22	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	100	95-100	95-100	85-100	40-65	25-40
	22-60	Stratified silty clay loam to very fine sandy loam.	CL	A-6, A-7	0	100	100	95-100	95-100	30-45	10-25
62A----- Del Rey	0-9	Silt loam-----	CL, ML, CL-ML	A-6, A-4, A-7	0	95-100	95-100	90-98	75-95	25-50	5-20
	9-24	Silty clay loam, silty clay.	CH, CL	A-7, A-6	0	95-100	95-100	90-100	70-95	35-55	15-30
	24-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	30-50	10-25
63----- Henrietta	0-12	Sapric material	Pt	A-8	---	---	---	---	---	---	---
	12-43	Stratified loamy fine sand to silt loam.	CL, ML, SM, SC	A-2-4, A-4	0	95-100	85-100	50-100	25-85	<25	2-10
	43-60	Stratified loamy fine sand to silt loam.	CL, ML, SM, SC	A-2-4, A-4	0	95-100	85-100	50-100	25-85	<25	2-10
64B*, 64C*: Marlette-----	0-8	Loam-----	CL, ML, CL-ML	A-4	0-5	95-100	85-95	80-95	60-70	20-30	3-10
	8-32	Loam, clay loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	80-100	55-90	20-40	5-25
	32-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	75-95	50-75	20-40	5-25
Owosso-----	0-12	Sandy loam-----	SM, SM-SC, SC	A-2, A-4	0-5	95-100	75-100	50-70	20-45	12-29	NP-10
	12-32	Sandy loam, sandy clay loam, clay loam.	SM, SC, ML, CL	A-2, A-4	0-5	95-100	75-100	60-90	25-60	15-30	NP-10
	32-60	Loam, silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	90-95	85-95	60-90	25-40	6-21
65A----- Capac	0-14	Loam-----	CL, ML, CL-ML	A-4	0-5	95-100	90-100	80-95	60-75	<25	3-10
	14-34	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	90-100	85-100	50-80	25-40	5-20
	34-60	Loam-----	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	80-95	60-75	15-35	5-15
66E----- Eleva Variant	0-6	Channery fine sandy loam.	SM, SM-SC, SC	A-2-4, A-1-B	0-20	70-90	60-80	35-55	20-30	<20	NP-10
	6-24	Very channery sandy loam.	SM, SC, SM-SC, SP-SM	A-2-4, A-2-6, A-1-B	5-20	65-85	55-75	30-50	12-30	<25	NP-10
	24-28	Weathered bedrock	---	---	---	---	---	---	---	---	---
67B----- Whalan	0-11	Loam-----	ML	A-4	0	100	95-100	85-95	60-90	30-40	5-10
	11-21	Clay loam, loam	CL	A-6	0	95-100	95-100	80-95	70-90	30-40	10-15
	21-30	Clay loam, clay, silty clay loam.	CL, CH	A-7	0-5	80-100	70-95	65-90	50-85	40-60	20-35
	30	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	<u>In</u>				<u>Pct</u>					<u>Pct</u>	
68B*, 68C*: Oshtemo-----	0-17	Sandy loam-----	SM, SM-SC	A-2, A-4	0	95-100	60-95	60-70	25-40	15-25	2-7
	17-28	Gravelly sandy loam, gravelly sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	95-100	60-95	60-85	25-45	12-30	2-16
	28-50	Loamy sand-----	SM, SP-SM	A-2	0	85-95	60-95	55-70	10-15	---	NP
	50-60	Stratified coarse sand to gravel.	SP-SM, GP, SP, GP-GM	A-1, A-2, A-3	0-5	40-90	35-85	20-60	0-10	---	NP
Leoni-----	0-13	Gravelly sandy loam.	SM	A-2, A-4	1-20	85-95	75-90	60-80	30-50	<30	NP-7
	13-29	Cobbly clay loam, gravelly sandy clay loam, gravelly sandy loam.	CL, SC, GC	A-6, A-4	10-50	70-85	60-85	50-70	40-60	25-40	8-20
	29-42	Cobbly sandy loam, cobbly sandy clay loam, gravelly clay loam.	SM, SC, SM-SC, SP-SM	A-2, A-1	10-50	70-85	60-85	40-50	10-25	<25	NP-8
	42-60	Cobbly sand, cherty loamy sand, very gravelly sandy loam.	SM, SP-SM, SC, SM-SC	A-1, A-2, A-4	5-60	65-85	40-80	35-50	5-40	<22	NP-8

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		Pct
11B*, 11C*, 11D*: Boyer-----	0-11 11-34 34-60	5-15 10-18 0-10	1.14-1.60 1.26-1.59 1.20-1.47	2.0-6.0 2.0-6.0 >20	0.10-0.15 0.12-0.18 0.02-0.04	5.6-7.3 5.6-7.8 7.4-8.4	Low----- Low----- Low-----	0.24 0.24 0.10	4	3	.5-3
Oshtemo-----	0-17 17-28 28-60	2-10 10-22 0-15	1.14-1.60 1.20-1.59 1.20-1.47	2.0-6.0 2.0-6.0 >20	0.10-0.15 0.12-0.19 0.02-0.04	5.1-6.5 5.1-6.5 7.4-8.4	Low----- Low----- Low-----	0.24 0.24 0.10	5	3	.5-3
11E*: Boyer-----	0-11 11-34 34-60	5-15 10-18 0-10	1.14-1.60 1.26-1.59 1.20-1.47	2.0-6.0 2.0-6.0 >20	0.10-0.15 0.12-0.18 0.02-0.04	5.6-7.3 5.6-7.8 7.4-8.4	Low----- Low----- Low-----	0.24 0.24 0.10	4	3	.5-3
Leoni-----	0-13 13-29 29-42 42-60	2-18 18-35 18-35 0-18	1.30-1.70 1.30-1.70 1.30-1.70 1.20-1.50	0.6-6.0 0.6-2.0 2.0-6.0 2.0-20	0.07-0.15 0.06-0.12 0.03-0.09 0.01-0.03	5.6-7.3 5.1-7.3 5.6-7.8 7.4-8.4	Low----- Moderate----- Low----- Low-----	0.10 0.10 0.10 0.10	3	8	1-3
13B*, 13C*, 13D*: Ormas-----	0-21 21-26 26-45 45-60	5-12 10-20 18-25 1-8	1.40-1.60 1.50-1.70 1.50-1.60 1.55-1.70	2.0-6.0 2.0-6.0 2.0-6.0 >20	0.10-0.12 0.12-0.14 0.11-0.14 0.03-0.05	5.6-7.3 5.1-6.5 5.6-7.8 7.4-8.4	Low----- Low----- Low----- Low-----	0.17 0.17 0.32 0.15	5	2	1-3
Spinks-----	0-18 18-29 29-68	0-10 3-15 0-15	1.14-1.60 1.26-1.59 1.20-1.47	6.0-20 6.0-20 2.0-20	0.06-0.08 0.08-0.10 0.04-0.08	5.1-7.3 5.6-7.3 5.6-7.8	Low----- Low----- Low-----	0.17 0.17 0.17	5	1	2-4
14B, 14C, 14D--- Spinks	0-18 18-29 29-68	0-10 3-15 0-15	1.14-1.60 1.26-1.59 1.20-1.47	6.0-20 6.0-20 2.0-20	0.06-0.08 0.08-0.10 0.04-0.08	5.1-7.3 5.6-7.3 5.6-7.8	Low----- Low----- Low-----	0.17 0.17 0.17	5	1	2-4
15A----- Teasdale	0-13 13-55 55-65	5-15 10-18 5-15	1.25-1.75 1.40-1.85 1.70-1.95	2.0-6.0 0.6-2.0 2.0-6.0	0.12-0.15 0.11-0.17 0.08-0.15	5.1-6.5 4.5-7.3 6.6-8.4	Low----- Low----- Low-----	0.24 0.24 0.24	5	3	2-3
16A----- Brady	0-13 13-30 30-54 54-60	2-15 5-22 5-20 0-10	1.25-1.41 1.35-1.45 1.25-1.50 1.25-1.50	2.0-6.0 2.0-6.0 2.0-20 >20	0.12-0.15 0.12-0.17 0.08-0.10 0.02-0.04	5.6-7.3 5.1-6.5 5.1-6.5 6.6-8.4	Low----- Low----- Low----- Low-----	0.20 0.20 0.20 0.10	5	3	1-4
17----- Barry	0-10 10-26 26-60	8-18 18-25 5-18	1.60-1.75 1.25-1.85 1.80-2.00	0.6-2.0 0.6-2.0 2.0-6.0	0.20-0.22 0.14-0.19 0.10-0.13	6.1-7.8 6.1-7.8 7.4-8.4	Low----- Low----- Low-----	0.28 0.28 0.28	5	5	4-7
18*: Gilford-----	0-15 15-35 35-60	10-20 8-17 3-12	1.50-1.70 1.60-1.80 1.70-1.90	2.0-6.0 2.0-6.0 6.0-20	0.13-0.15 0.10-0.14 0.05-0.08	5.6-6.5 5.6-7.3 6.6-8.4	Low----- Low----- Low-----	0.20 0.20 0.15	4	3	2-4
Colwood-----	0-16 16-33 33-60	5-26 18-35 0-12	1.14-1.60 1.26-1.59 1.20-1.47	0.6-2.0 0.6-2.0 0.6-2.0	0.20-0.24 0.17-0.22 0.12-0.22	6.1-7.8 6.1-8.4 7.4-8.4	Low----- Moderate----- Low-----	0.28 0.43 0.43	5	5	1-4
20----- Houghton	0-60	---	0.15-0.45	0.2-6.0	0.35-0.45	5.6-7.8	-----	---	---	3	>70
22----- Cohoctah	0-11 11-40 40-60	5-20 5-27 2-25	1.12-1.59 1.48-1.80 1.46-1.95	2.0-6.0 2.0-6.0 2.0-6.0	0.13-0.22 0.12-0.20 0.08-0.20	6.1-7.8 6.1-8.4 6.1-8.4	Low----- Low----- Low-----	0.28 0.28 0.28	5	3	1-4

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodi- bility group	Organic matter
								K	T		
	In	Pct	G/cm ³	In/hr	In/in	pH					Pct
29A----- Kibbie	0-9 9-27 27-60	2-20 5-35 2-18	1.43-1.73 1.44-1.81 1.47-1.90	0.6-2.0 0.6-2.0 0.6-2.0	0.16-0.20 0.17-0.22 0.12-0.22	5.6-7.3 5.6-7.3 7.4-8.4	Low----- Low----- Low-----	0.20 0.43 0.43	5	3	1-3
30----- Edwards	0-28 28-60	--- ---	0.30-0.55 ---	0.2-6.0 ---	0.35-0.45 ---	5.6-7.8 7.4-8.4	----- -----	----- -----	---	3	55-75
35B*, 35C*, 35D*: Arkport-----	0-8 8-21 21-62 62-66	5-18 3-15 1-5 1-5	1.10-1.40 1.25-1.55 1.25-1.55 1.25-1.55	2.0-6.0 2.0-6.0 2.0-6.0 2.0-6.0	0.08-0.09 0.06-0.16 0.06-0.12 0.02-0.06	4.5-7.3 4.5-7.3 5.1-7.3 5.6-7.8	Low----- Low----- Low----- Low-----	0.17 0.43 0.43 0.43	3	2	2-6
Okee-----	0-24 24-52 52-58 58-66	4-10 10-18 4-15 4-15	1.55-1.70 1.55-1.70 1.55-1.65 1.35-1.85	2.0-6.0 0.6-2.0 0.6-6.0 0.6-6.0	0.12-0.14 0.12-0.16 0.09-0.11 0.07-0.12	6.1-7.3 5.6-7.8 5.6-7.8 7.4-8.4	Low----- Low----- Low----- Low-----	0.17 0.28 0.28 0.28	4	2	.5-2
37----- Palms	0-32 32-60	--- 7-35	0.25-0.45 1.46-2.00	0.2-6.0 0.2-2.0	0.35-0.45 0.14-0.22	5.1-8.4 6.1-8.4	----- Low-----	----- -----	---	3	>75
39A*: Ypsi-----	0-8 8-29 29-60	5-18 5-20 40-60	1.29-1.72 1.40-1.83 1.43-1.81	2.0-6.0 2.0-6.0 0.06-0.2	0.12-0.16 0.10-0.14 0.06-0.10	6.1-7.3 6.1-7.3 7.4-8.4	Low----- Low----- High-----	0.20 0.20 0.32	4	3	1-3
Wauseon-----	0-13 13-36 36-60	7-20 5-18 27-55	1.20-1.60 1.30-1.70 1.50-1.90	2.0-6.0 6.0-20 <0.06	0.20-0.22 0.06-0.16 0.08-0.18	6.1-7.3 6.6-7.8 7.4-8.4	Low----- Low----- High-----	0.28 0.20 0.32	4	4	4-8
40----- Lenawee	0-9 9-38 38-60	10-27 35-45 18-40	0.91-1.55 1.39-1.78 1.51-1.80	0.6-2.0 0.2-0.6 0.6-2.0	0.20-0.24 0.18-0.20 0.18-0.22	5.6-6.0 6.6-7.8 7.4-7.8	Low----- Moderate----- Low-----	0.28 0.28 0.28	4	6	2-5
42A, 42B, 42C, 42D----- Riddles	0-13 13-19 19-44 44-60	4-14 18-35 20-35 8-25	1.35-1.55 1.40-1.60 1.40-1.60 1.40-1.60	2.0-6.0 0.6-2.0 0.6-2.0 0.6-2.0	0.13-0.15 0.16-0.18 0.15-0.19 0.05-0.19	6.1-7.3 5.1-7.3 5.1-7.3 6.6-8.4	Low----- Moderate----- Moderate----- Low-----	0.24 0.32 0.32 0.32	5	3	.5-2
43A----- Dixboro	0-17 17-52 52-66	2-15 6-17 0-15	1.30-1.70 1.40-1.80 1.50-1.70	2.0-6.0 0.6-2.0 0.6-2.0	0.16-0.22 0.10-0.20 0.07-0.20	5.6-7.3 5.6-7.8 7.4-8.4	Low----- Low----- Low-----	0.20 0.20 0.20	5	3	2-3
44B, 44C, 44D---- Leoni	0-13 13-29 29-42 42-60	2-18 18-35 18-35 0-18	1.30-1.70 1.30-1.70 1.30-1.70 1.20-1.50	0.6-6.0 0.6-2.0 2.0-6.0 2.0-20	0.07-0.15 0.06-0.12 0.03-0.09 0.01-0.03	5.6-7.3 5.1-7.3 5.6-7.8 7.4-8.4	Low----- Moderate----- Low----- Low-----	0.10 0.10 0.10 0.10	3	8	1-3
45----- Martisco	0-8 8-60	--- ---	--- ---	0.6-6.0 0.06-0.2	0.25-0.35 ---	6.1-8.4 7.9-8.4	Low----- Low-----	----- -----	---	---	---
46----- Sebewa	0-15 15-35 35-60	10-25 18-35 0-3	1.15-1.60 1.50-1.80 1.55-1.75	0.6-2.0 0.6-2.0 6.0-20	0.18-0.22 0.15-0.19 0.02-0.04	6.1-7.8 6.1-7.8 7.4-8.4	Low----- Low----- Low-----	0.24 0.24 0.10	4	5	1-4
47*: Histosols. Aquents.											
48----- Napoleon	0-10 10-60	--- ---	0.30-0.40 0.10-0.20	0.2-6.0 0.6-6.0	0.35-0.45 0.45-0.55	<4.5 <4.5	----- -----	----- -----	---	2	---

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodi- bility group	Organic matter
								K	T		
	In	Pct	G/cm ³	In/hr	In/in	pH					Pct
49B*, 49C*, 49D*, 49E*:											
Hillsdale-----	0-10	2-15	1.10-1.64	0.6-6.0	0.13-0.22	5.1-7.3	Low-----	0.24	5	3	1-3
	10-15	5-15	1.22-1.87	2.0-6.0	0.13-0.15	4.5-6.5	Low-----	0.24			
	15-63	10-22	1.22-1.87	0.6-6.0	0.12-0.18	4.5-6.5	Low-----	0.24			
	63-66	0-15	1.31-1.99	2.0-6.0	0.11-0.13	7.9-8.4	Low-----	0.24			
Riddles-----	0-13	4-14	1.35-1.55	2.0-6.0	0.13-0.15	6.1-7.3	Low-----	0.24	5	3	.5-2
	13-19	18-35	1.40-1.60	0.6-2.0	0.16-0.18	5.1-7.3	Moderate----	0.32			
	19-44	20-35	1.40-1.60	0.6-2.0	0.15-0.19	5.1-7.3	Moderate----	0.32			
	44-60	8-25	1.40-1.60	0.6-2.0	0.05-0.19	6.6-8.4	Low-----	0.32			
51*: Udorthents. Udipsamments.											
52*, 53*. Pits											
55B, 55C-----	0-16	5-15	1.40-1.70	2.0-6.0	0.13-0.18	5.1-7.3	Low-----	0.24	4	3	1-3
Eleva	16-29	10-18	1.50-1.70	0.6-6.0	0.12-0.19	5.1-6.5	Low-----	0.24			
	29-45	---	---	---	---	---	-----	---			
56D*: Riddles-----	0-13	4-14	1.35-1.55	2.0-6.0	0.13-0.15	6.1-7.3	Low-----	0.24	5	3	.5-2
	13-19	18-35	1.40-1.60	0.6-2.0	0.16-0.18	5.1-7.3	Moderate----	0.32			
	19-44	20-35	1.40-1.60	0.6-2.0	0.15-0.19	5.1-7.3	Moderate----	0.32			
	44-60	8-25	1.40-1.60	0.6-2.0	0.05-0.19	6.6-8.4	Low-----	0.32			
Leoni-----	0-13	2-18	1.30-1.70	0.6-6.0	0.07-0.15	5.6-7.3	Low-----	0.10	3	8	1-3

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodi- bility group	Organic matter
								K	T		
	In	Pct	G/cm ³	In/hr	In/in	pH					Pct
60#: Udorthents.											
61B----- Saylesville	0-10 10-22 22-60	12-25 35-45 25-35	1.35-1.55 1.60-1.70 1.60-1.75	0.6-2.0 0.2-0.6 0.2-0.6	0.20-0.24 0.09-0.13 0.18-0.20	5.6-7.8 6.6-7.8 7.4-8.4	Low----- Moderate----- Moderate-----	0.37 0.37 0.37	3	5	1-3
62A----- Del Rey	0-9 9-24 24-60	20-30 35-45 25-35	1.30-1.50 1.35-1.55 1.45-1.65	0.6-2.0 0.06-0.2 0.06-0.2	0.22-0.24 0.12-0.20 0.09-0.11	5.1-6.5 6.1-8.4 7.9-8.4	Low----- Moderate----- Moderate-----	0.43 0.43 0.43	3	6	2-3
63----- Henrietta	0-12 12-43 43-60	--- 5-18 5-18	0.22-0.52 1.48-1.80 1.46-1.95	0.2-6.0 0.6-2.0 0.6-2.0	0.35-0.45 0.09-0.22 0.08-0.22	5.6-7.8 5.6-7.8 7.9-8.4	----- Low----- Low-----	----- 0.28 0.28	---	3	42-64
64B*, 64C*: Marlette-----	0-8 8-32 32-60	10-18 18-30 15-25	1.31-1.78 1.31-1.86 1.33-1.89	2.0-6.0 0.2-2.0 0.2-2.0	0.18-0.22 0.18-0.20 0.12-0.19	5.6-7.3 5.6-7.8 7.9-8.4	Low----- Low----- Low-----	0.32 0.32 0.32	5	5	1-3
Owosso-----	0-12 12-32 32-60	5-18 10-22 18-35	1.10-1.65 1.10-1.65 1.30-1.75	2.0-6.0 2.0-6.0 0.2-0.6	0.13-0.18 0.09-0.17 0.14-0.20	5.1-7.3 5.1-7.3 5.1-8.4	Low----- Low----- Moderate-----	0.24 0.24 0.37	5	3	1-2
65A----- Capac	0-14 14-34 34-60	10-18 18-35 10-25	1.43-1.73 1.44-1.81 1.47-1.90	0.6-2.0 0.2-2.0 0.2-2.0	0.18-0.20 0.14-0.18 0.14-0.16	5.6-7.3 5.6-7.3 7.4-8.4	Low----- Low----- Low-----	0.32 0.32 0.32	5	5	1-3
66E----- Eleva Variant	0-6 6-24 24-28	3-15 10-18 ---	1.10-1.64 1.22-1.59 ---	2.0-6.0 2.0-6.0 ---	0.06-0.12 0.06-0.09 ---	5.1-7.3 5.1-6.5 ---	Low----- Low----- -----	0.17 0.17 ---	3	8	1-3
67B----- Whalan	0-11 11-21 21-30 30	18-25 18-35 35-60 ---	1.30-1.45 1.40-1.55 1.35-1.45 ---	0.6-2.0 0.6-2.0 0.06-0.6 ---	0.22-0.24 0.17-0.19 0.15-0.19 ---	5.6-7.3 5.1-6.5 5.6-7.8 ---	Low----- Low----- High----- -----	0.32 0.32 0.32 ---	4	6	1-2
68B*, 68C*: Oshtemo-----	0-17 17-28 28-50 50-60	2-10 10-22 5-15 0-15	1.14-1.60 1.20-1.59 1.20-1.59 1.20-1.47	2.0-6.0 2.0-6.0 6.0-20 >20	0.10-0.15 0.12-0.19 0.06-0.08 0.02-0.04	5.1-6.5 5.1-6.5 5.1-7.3 7.4-8.4	Low----- Low----- Low----- Low-----	0.24 0.24 0.17 0.10	5	3	.5-3
Leoni-----	0-13	2-18	1.30-1.70	0.6-6.0	0.07-0.15	5.6-7.3	Low-----	0.10	3	8	1-3

TABLE 17.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Total		Uncoated steel	Concrete
					<u>Ft</u>			<u>In</u>			
11B*, 11C*, 11D*: Boyer-----	B	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Moderate.
Oshtemo-----	B	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	High.
11E*: Boyer-----	B	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Moderate.
Leoni-----	B	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Moderate.
13B*, 13C*, 13D*: Ormas-----	B	None-----	---	---	>6.0	---	---	---	Moderate	Low-----	Moderate.
Spinks-----	A	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Low.
14B, 14C, 14D----- Spinks	A	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Low.
15A----- Teasdale	B	None-----	---	---	0.5-1.5	Apparent	Nov-May	---	High-----	Moderate	Moderate.
16A----- Brady	B	None-----	---	---	1.0-3.0	Apparent	Nov-May	---	High-----	Low-----	Moderate.
17----- Barry	B/D	None-----	---	---	+1-1.0	Apparent	Nov-May	---	High-----	High-----	Low.
18*: Gilford-----	B	None-----	---	---	+1.5-1.0	Apparent	Sep-Jun	---	High-----	High-----	Moderate.
Colwood-----	B/D	None-----	---	---	+1-1.5	Apparent	Oct-May	---	High-----	High-----	Low.
20----- Houghton	A/D	None-----	---	---	+1-1.0	Apparent	Sep-Jun	55-60	High-----	High-----	Low.
22----- Cohoctah	B/D	Frequent----	Brief-----	Jan-Dec	0-1.0	Apparent	Sep-May	---	High-----	High-----	Low.
29A----- Kibbie	B	None-----	---	---	1.0-2.0	Apparent	Nov-May	---	High-----	Low-----	High.
30----- Edwards	B/D	None-----	---	---	+1-0.5	Apparent	Sep-Jun	25-30	High-----	High-----	Low.
35B*, 35C*, 35D*: Arkport-----	B	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Moderate.
Okee-----	A	None-----	---	---	>6.0	---	---	---	Low-----	Moderate	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Total		Uncoated steel	Concrete
					<u>Ft</u>			<u>In</u>			
37----- Palms	A/D	None-----	---	---	+1-1.0	Apparent	Nov-May	25-32	High-----	High-----	Moderate.
39A*: Ypsi-----	C	None-----	---	---	1.0-2.0	Perched	Nov-May	---	High-----	High-----	Moderate.
Wauseon-----	B/D	None-----	---	---	+1-1.0	Perched	Jan-Apr	---	High-----	High-----	Low.
40----- Lenawee	B/D	None-----	---	---	+1-1.0	Apparent	Nov-May	---	High-----	High-----	Low.
42A, 42B, 42C, 42D----- Riddles	B	None-----	---	---	>6.0	---	---	---	Moderate	Moderate	Moderate.
43A----- Dixboro	B	None-----	---	---	1.0-2.0	Apparent	Nov-Apr	---	High-----	Moderate	Moderate.
44B, 44C, 44D----- Leoni	B	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Moderate.
45----- Martisco	D	None-----	---	---	+1-1.0	Apparent	Oct-Jun	---	High-----	High-----	Low.
46----- Sebewa	B/D	None-----	---	---	+1-1.0	Apparent	Sep-May	---	High-----	High-----	Low.
47*: Histosols. Aquents.											
48----- Napoleon	A/D	None-----	---	---	+1-1.0	Apparent	Sep-Jun	50-59	High-----	Moderate	High.
49B*, 49C*, 49D*, 49E*: Hillsdale-----	B	None-----	---	---	>6.0	---	---	---	Moderate	Low-----	High.
Riddles-----	B	None-----	---	---	>6.0	---	---	---	Moderate	Moderate	Moderate.
51*: Udorthents. Udipsamments.											
52*, 53*. Pits											
55B, 55C----- Eleva	B	None-----	---	---	>6.0	---	---	---	Moderate	Low-----	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence Total	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth Ft	Kind	Months			Uncoated steel	Concrete
56D*: Riddles-----	B	None-----	---	---	>6.0	---	---	---	Moderate	Moderate	Moderate.
Leon-----	B	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Moderate.
57A*: Urban land.											
Barry-----	B/D	None-----	---	---	+1-1.0	Apparent	Nov-May	---	High-----	High-----	Low.
Brady-----	B	None-----	---	---	1.0-3.0	Apparent	Nov-May	---	High-----	Low-----	Moderate.
58B*, 58C*: Urban land.											
Oshtemo-----	B	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	High.
59B*, 59C*: Urban land.											
Riddles-----	B	None-----	---	---	>6.0	---	---	---	Moderate	Moderate	Moderate.
60*: Urban land.											
Udorthents.											
61B----- Saylesville	C	None-----	---	---	>6.0	---	---	---	Moderate	High-----	Moderate.
62A----- Del Rey	C	None-----	---	---	1.0-3.0	Apparent	Jan-May	---	High-----	High-----	Low.
63----- Henrietta	D	None-----	---	---	+1-1.0	Apparent	Nov-Jun	---	High-----	High-----	Low.
64B*, 64C*: Marlette-----	B	None-----	---	---	>6.0	---	---	---	Moderate	Low-----	Moderate.
Owosso-----	B	None-----	---	---	>6.0	---	---	---	Moderate	Moderate	Moderate.
65A----- Capac	B	None-----	---	---	1.0-2.0	Apparent	Nov-May	---	High-----	High-----	Low.
66E----- Eleva Variant	B	None-----	---	---	>6.0	---	---	---	Moderate	Low-----	Moderate.
67B----- Whalan	B	None-----	---	---	>6.0	---	---	---	Moderate	Moderate	Low.
68B*, 68C*: Oshtemo-----	B	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	High.
Leon-----	B	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Aquents-----	Mixed, nonacid, mesic Aquents
Arkport-----	Coarse-loamy, mixed, mesic Psammentic Hapludalfs
Barry-----	Fine-loamy, mixed, mesic Typic Argiaquolls
Boyer-----	Coarse-loamy, mixed, mesic Typic Hapludalfs
Brady*-----	Coarse-loamy, mixed, mesic Aquollic Hapludalfs
Capac-----	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Cohoctah-----	Coarse-loamy, mixed, mesic Fluvaquentic Haplaquolls
Colwood-----	Fine-loamy, mixed, mesic Typic Haplaquolls
Del Rey-----	Fine, illitic, mesic Aeric Ochraqualfs
Dixboro*-----	Coarse-loamy, mixed, mesic Aquollic Hapludalfs
Edwards-----	Marly, euic, mesic Limnic Medisaprists
Eleva-----	Coarse-loamy, mixed, mesic Typic Hapludalfs
Eleva Variant-----	Loamy-skeletal, mixed, mesic Typic Hapludalfs
Gilford-----	Coarse-loamy, mixed, mesic Typic Haplaquolls
Henrietta-----	Coarse-loamy, mixed, mesic Histic Humaquepts
Hillsdale-----	Coarse-loamy, mixed, mesic Typic Hapludalfs
Histosols-----	Euic, mesic Histosols
Houghton-----	Euic, mesic Typic Medisaprists
Kibbie*-----	Fine-loamy, mixed, mesic Aquollic Hapludalfs
Lenawee-----	Fine, mixed, nonacid, mesic Mollic Haplaquepts
Leoni-----	Loamy-skeletal, mixed, mesic Typic Hapludalfs
Marlette-----	Fine-loamy, mixed, mesic Glossoboric Hapludalfs
Martisco-----	Fine-silty, carbonatic, mesic Histic Humaquepts
Napoleon-----	Dysic, mesic Typic Medihemists
Okee-----	Loamy, mixed, mesic Arenic Hapludalfs
Ormas-----	Loamy, mixed, mesic Arenic Hapludalfs
Oshtemo-----	Coarse-loamy, mixed, mesic Typic Hapludalfs
Owosso-----	Fine-loamy, mixed, mesic Typic Hapludalfs
Palms-----	Loamy, mixed, euic, mesic Terric Medisaprists
Riddles-----	Fine-loamy, mixed, mesic Typic Hapludalfs
<hr/>	
Saylesville-----	Fine, illitic, mesic Typic Hapludalfs
Sebewa-----	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Argiaquolls
Spinks-----	Sandy, mixed, mesic Psammentic Hapludalfs
Teasdale-----	Coarse-loamy, siliceous, mesic Glossaquic Hapludalfs
Udipsamments-----	Mixed, mesic Udipsamments
Udorthents-----	Loamy, mixed, mesic Udorthents
Wauseon*-----	Coarse-loamy over clayey, mixed, mesic Typic Haplaquolls
Whalan-----	Fine-loamy, mixed, mesic Typic Hapludalfs
Ypsi-----	Coarse-loamy over clayey, mixed, mesic Udollic Ochraqualfs

*The soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.